

H.R. 5880—AUTOMOBILE RESEARCH COMPETITION ACT

HEARING
BEFORE THE
SUBCOMMITTEE ON TRANSPORTATION,
AVIATION AND MATERIALS
OF THE
COMMITTEE ON
SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES
NINETY-SEVENTH CONGRESS
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H.R. 5880—AUTOMOBILE RESEARCH COMPETITION ACT

TUESDAY, JUNE 15, 1982

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE AND TECHNOLOGY,
SUBCOMMITTEE ON TRANSPORTATION, AVIATION AND MATERIALS,
Washington, D.C.

The subcommittee met, pursuant to notice, at 9:35 a.m., in room 2325, Rayburn House Office Building, Hon. Dan Glickman (chairman of the subcommittee) presiding.

Present: Representatives Glickman, Harkin, Shamansky, Dunn, and Hollenbeck.

Mr. GLICKMAN. Good morning.

Today the Subcommittee on Transportation, Aviation and Materials will focus on H.R. 5880, a bill introduced by our colleague on the subcommittee, Congressman Bob Shamansky of Ohio.

This bill embodies a novel approach to solving two vitally important problems: Our dependence on foreign petroleum and the poor competitive position of our automobile industry. It does this by establishing a federally sponsored competition to design and build a practical, cost-competitive, fuel-efficient automobile. The winner would then receive a prize of up to \$140 million, conceivably.

I think Bob Shamansky is to be commended for introducing this innovative legislation. I do believe that we must look for new approaches to the dilemma of Detroit, and this piece of legislation certainly does that. The bill appears to have considerable merit, and for that reason I have called this hearing to gather the views and judgments of experts. Based on that, we will decide the need for further committee action.

Before we begin, since I am the only member here, I indicate that there is no objection to television coverage or radio coverage of the subcommittee hearing today.

I see that our ranking minority member, Mr. Dunn of Michigan has come in. Of course Michigan has a great deal of interest in these issues.

Do you have a statement that you would like to make, Mr. Dunn?

Mr. DUNN. Thank you, Mr. Chairman. Let me reserve the opportunity to make a statement later.

Mr. GLICKMAN. All right. Then let us go ahead and start. Let us ask Mr. Shamansky to begin his testimony, and then after his testimony, you may wish to make a statement.

Bob?

STATEMENT OF HON. BOB SHAMANSKY, A REPRESENTATIVE IN
CONGRESS FROM THE STATE OF OHIO

Mr. SHAMANSKY. Thank you, Mr. Chairman.

I very much appreciate the opportunity to testify before this subcommittee on the Automobile Research Competition Act, which I think has great potential.

As you may know, the bill was entered simultaneously in the Senate by Senator Ted Stevens, the majority whip of the other body. We were able to talk about this legislation and I think he appreciates the importance of it to this country. So it is truly a bipartisan effort.

I would like to submit for the record my prepared testimony. I will, at best, refer to it in paraphrase only; I will not read it.

Mr. GLICKMAN. Without objection, your entire statement will be included in the record.

Mr. SHAMANSKY. I would like to begin, because events are happening so rapidly in this area, by referring to an AP article in the Columbus Dispatch yesterday that says, "a 68-mile-per-gallon Honda city model unlikely to leave Japan." This is a car reportedly capable of getting 68 miles per gallon on the highway while offering more passenger room than usual on small cars. A California economics professor estimates the car could be sold for \$3,500 in the United States and predicts it could capture 60 percent of the U.S. auto market if it is sold here.

Honda has a plant in the county adjacent to Franklin County, which is my home; it is not in my congressional district. I am only suggesting to you that the Japanese are prepared to manufacture here, and we have to look to the future.

Also, we have to recognize that there have been newspaper reports that Volkswagen of Germany is working on a car to get 75 miles per gallon.

With that background, I would like to refer briefly to a couple of recent articles that have appeared in the New York Times. This is from the New York Times of Sunday, the business section. It says, "Management gospel gone wrong." We are really talking about when we discuss the ills of the U.S. auto industry is where is the positive forward-looking management that we require? The article notes that Harvard's Hayes and Abernathy, two professors, say the best and brightest have led American business astray but that companies are listening.

Hayes and Abernathy wrote the well-read article "Managing Our Way to Economic Decline," which appeared in the July-August 1980, issue of the prestigious Harvard Business Review. It expressed the conviction that American managers had fallen into a self-defeating preoccupation with short-term profits at the expense of long-term bets on technology.

According to the Times, the two professors—were willing to stand up and say "the emperor"—that is, American industry—"has no clothes."

I would like also to refer to part of this article which says that, "the noted emphasis in American management techniques in the last 20 years on financial techniques is giving way to new attention to technology and improved production."

The significance of the Automobile Research Competition Act is that it assumes the technology is available. There are no magical inventions that have to be made.

One last reference to the Times piece: It says that American business has been acting so that it is making poor longrun strategic decisions, especially with respect to productivity and technology.

We have had hours of hearings in our committee over the past year and a third in which we have been talking about productivity and technology. I think the import of this bill is to acknowledge that the technology exists; the question is, will we make use of it?

I would like to make one other reference from the New York Times, which relates to the topic before us. This is from the New York Times magazine for Sunday, June 6, 1982. It says, on page 62, "The fashionable notion of letting the market have its way, of backing winners, not losers, is attacked by Felix Rohatyn." "The losers today," he says, "are automotive steel, glass, rubber, and other basic industries."

Although, Mr. Chairman, you are from Kansas, I am sure you can appreciate that all those industries mentioned are, to a great extent, Ohio industries. Ohio has been the workshop of the United States, and there is an economic depression along the northern tier of Ohio counties. These are very serious matters for us.

It goes on, "He—Rohatyn—wonders whether the Nation can continue to function while writing off basic industries to foreign competition." Rohatyn says, "We cannot become a nation of short-order cooks and saleswomen." High-tech companies and service companies cannot stand alone. They still require a healthy, industrial base, plants to produce the energy and the steel that go into a computer.

Referring to a Mr. Delancy, the steelmaker, he sounds a similar note—Mr. Delancy speaking—"I think it would be a great misfortune for this country to become a nation of shopkeepers and electronic chipmakers."

From the point of view of such experts as Harley Shakin, the basic answer to America's ills is a return to the Nation's days of innovation. Quoting Mr. Shakin,

We must design products so imaginative, so extraordinary in what they do, that they either create their own markets or capture other markets—for example, a car that gets 80 miles to a gallon of gasoline.

American companies have lost the basic ability to create quality products, Shakin says. The article goes on, "Management has taken a leap away from the mundane world of making things and into the glorification of management as a science."

The article adds that Rohatyn holds that no desirable solutions are possible without the formulation of regional goals that are, in turn, tied into national economic planning, and for Ohio this approach is extremely important, as it is for the entire industrial Midwest.

Now, I want to refer briefly to a report that I personally commissioned back in 1978 from Frank Foster, who is a patent lawyer in Columbus.

I should explain, Mr. Chairman, that for many years I drove Fords. I knew that I needed a new Ford when I could begin to look through the floorboards; that told me I needed a new car.

In Columbus, when it snows for a good part of the winter, as the windshield wipers would work, the ice builds up. Motorists cannot see out. I said to myself, after driving Fords for decades, when I got a Cadillac, the icing problem would somehow or other disappear.

To my amazement, driving in a 1978 Cadillac Seville, with all kinds of buttons on it, including a rear-window defroster, I still had the ice buildup on the windshield and I still could not see.

I then, being a very smart fellow, figured out that I could make a fortune just by putting an electric coil in the blade of the windshield wiper. And I was sure I had to check the patents, so that is when I contacted Frank Foster, who gave me this report. I actually paid him \$300 for it. Remember, in 1978 that was a lot of money.

His report points out that patents have been issued on this question of windshield wipers since 1921. There are 29 patents—as of 1978—showing heating elements embedded in the wiper blade. Several others showed heaters attached inside the wiper blade.

Then he went on to say in his cover letter, "In fact, it is clear to me that automobile manufacturers could most likely provide such an accessory or option without paying any royalties to anyone."

Therefore, in this situation, as with the automobile turn signal and many other automobile accessories, the automotive industry continues to be decades behind in applications of existing technology.

I just stopped last night in Columbus and bought some new wiper blades. The technology simply has not advanced.

After I got this patent report, Mr. Chairman, I called up the Columbus Public Library and got the names of manufacturers of wiper blades. I called the director of development of one company in Rhode Island. I introduced myself cold and asked had he ever heard of these electric filament wiper blades. He said, "Oh, sure; they are very old." I said, "Is there anything about them that you could not manufacture?" He said, "Oh, no; it would be very simple." I said, "Then why don't you manufacture them?" He said, "General Motors never asked for it."

I said, "Do you mean to tell me, if they asked for them and put them on the Cadillac one year, that all of the other cars would have had them the next year?" He said, "Sure, that is what would happen."

This anecdote illustrates a point: What Detroit too often does is take out last year's model and put last year's equipment on it, then put it on this year's car. Available technology that is not being utilized. In a larger sense, our basic industrial base—our entire economy—suffers because of this.

I will make one other reference. I am now driving a 1980 Cadillac Seville—diesel.

Mr. GLICKMAN. I have ridden in your car.

Mr. SHAMANSKY. Yes. And it has got buttons to the point of obscenity. This model has buttons I do not know what to do with.

Mr. DUNN. Is this an ad for Cadillac?

Mr. SHAMANSKY. Yes, in a way it is—or a complaint. The point is, if you take the FM dial clear to the left in Columbus, you pick

up channel 6 on TV, and you can hear the news. I happen to like news. If you ever listened to TV without the screen, you have reinvented radio; it is an amazing thing.

Now, I hold in my hand here a General Electric AM-FM radio with TV sound. It has two additional bands. I bought it at Sun TV in Columbus for about \$22. I cannot—and I checked in Columbus yesterday—I cannot get a Cadillac or any other car with this kind of radio, although, I am sure that if General Motors thought about it, they could put it in and get another \$100 out of me when I buy a car. You can listen to the news on television as well as watch it.

The purpose of my mentioning this is that there is a lot of technology out there that is available to this country. I cannot tell you why our automobile companies have not utilized it. I will let the business schools of the Nation worry about that. I am merely reporting the condition.

I am not going to testify as to the technological aspects. Dr. Fawcett, who is chairman and chief executive officer of Battelle, is more qualified to do that than I. I do want to stress that the bill that we have here is not a bailout for automobile companies. We would welcome the automobile companies' competition, but what we want to do is to provide an incentive for the other repositories of engineering and scientific expertise and industrial production in this country to apply their experience to the development of an automobile.

The economy in this country with respect to automobiles is such that the new model and new market leaders come from the Japanese and the Germans. The record shows that our American companies are simply not doing it.

The essence of my proposal, the Automobile Research Competition Act, is that the private sector will provide its money first; no Federal funds are expended until after the private sector risks its money first. If they meet these criteria, which Dr. Fawcett can talk about, only then will any money be expended. If all of the money is expended that is contemplated, we will be spending less than the cost of one Stealth bomber.

The advantage to this country with respect to OPEC and our utilization of fuel would be immense, and we would be doing it rather than having to buy the technology from the Japanese, the Germans, or anybody else.

I want to make one other important point. I have heard representatives of the automobile industry say that Americans prefer large cars and they would prove that by saying, "Americans, when given a choice, when gasoline was cheap, bought overwhelmingly American cars, which meant big cars." I checked the figures. In 1973—the oil embargo did not come until the fall of that year—83 percent of the cars sold were American-manufactured, so only 17 percent were of foreign manufacture. Let us assume for the purposes of discussion that these were smaller cars.

What the spokesmen for the automobile companies forget to point out is that it was a 10-million-car year, and 17 percent of 10 million cars is still 1.7 million units in absolute numbers, even when gasoline was cheap. That is a lot of cars. Would Detroit not love to be producing an additional 1.7 million cars today?

Dr. Fawcett and the other witnesses can talk about the logical progression from existing technology to revitalizing the American auto industry. We have got to stop shooting ourselves in the foot. I think there is a proper role for the Federal Government in this, and I am going to draw two analogies.

The Federal Government obtains war planes—military aircraft—by a competition similar to this, in which the companies—the manufacturing companies—are given certain criteria that the Air Force wants to incorporate in a particular type of plane. They then develop those planes, and the best one is awarded the contract, and they can recoup some of their development costs during the course of the contract.

England, at the height of the industrial revolution, had prizes and awards for inventions. I think we have got to be flexible. We have got to stop being ideological and theoretical and realize that there is an important role for Government to play.

The Middle West is suffering greatly due to the decline of basic industries. I am from the Middle West, and although Columbus is an area with a lot of science and technology related industries, and we will be able to compete in the computer age, as a region we must get back to basics of manufacturing, and the automobile is basic to our economy.

Thank you, Mr. Chairman, for the opportunity to testify.
[The prepared statement of Mr. Shamansky follows:]

TESTIMONY

BY

CONGRESSMAN BOB SHAMANSKY
U.S. HOUSE OF REPRESENTATIVES
OHIO'S 12th CONGRESSIONAL DISTRICT

BEFORE THE

SCIENCE AND TECHNOLOGY SUBCOMMITTEE ON
TRANSPORTATION, AVIATION AND MATERIALS
U.S. HOUSE OF REPRESENTATIVES

HEARING ON H.R. 5880, AUTOMOBILE RESEARCH COMPETITION ACT

Tuesday, June 15, 1982
Room 2325
Rayburn House Office Building

Mr. Chairman, I would like to thank you for the consideration you have shown this bill introduced by Senator Stevens and myself.

The Automobile Research Competition Act is a product of several years of discussions and research I have had with experts concerning the U.S. automobile industry and American energy consumption.

Our dangerous, and well-documented, energy dependence and the growing non-competitiveness of major U.S. automakers in world markets, and continued inroads by foreign car builders in our domestic market, make clear the seriousness of the situation.

The House Energy Subcommittee on Fossil and Synthetic Fuels heard last week that American crude oil imports are expected to increase to about 4.3 million barrels per day by the fourth quarter of this year—an increase of 1.5 million barrels from the average level of January through May.

A Congressional Research Service analysis prepared for the panel likened the situation to the 1978-79 experience, when oil companies drew down their petroleum stocks because of high carrying costs and then had to rebuild their inventories in a market dominated by the Iran crisis. The resulting scramble to reacquire inventory then contributed to a doubling in world oil prices, the report said. "There are now two shooting wars going on in the Mideast. Should either impair the Organization of Petroleum Exporting Countries' ability or willingness to accommodate an increased call on its oil of several million barrels per day, price increases and disruptions can be expected."

Such events have recurred since 1973. Even without supply disruptions,

the transfer of hundreds of billions of dollars from the U.S. to O.P.E.C. in the past nine years has been a major cause of our present economic stagnation. One response was Congress's mandating of fuel-efficiency standards for automobiles. Nevertheless, the auto industry moved slowly in meeting the new requirements and was caught unprepared when consumer demand mushroomed for fuel-efficient automobiles. Thus, foreign automakers fulfilled our consumer demands and now take roughly 30 percent of our domestic market.

To catch up with consumer demand and foreign competition the American auto industry will spend \$70 billion in redesign and retooling by 1985. It is expected to achieve an improved fuel economy fleet average of 31 mpg. In other words, it will take approximately 5 years and tens of billions of dollars to accomplish foreign automakers 1979 averages.

Why were we caught unprepared is something I can only speculate on. Now, I am concerned that we are not beaten again. Inevitably, increasing gasoline prices will lead consumers to demand ever more fuel efficient, high-quality automobiles. There is no need to allow foreign imports to hold 29.6 percent of our domestic market as they did in February of 1981. Unquestionably, improved fuel economy by domestic manufacturers will be critical to recapturing our domestic market and remaining competitive in the world market.

I posed the question, how can we recapture our market share and reduce our vulnerability to foreign imports? The answer was provided by Dr. Sherwood Fawcett, Chairman and Chief Executive Officer of Battelle Memorial Institute. Battelle is the world's largest non-profit private research institute, and developer, among other discoveries, of the process of Xerography.

Dr. Fawcett presented me with the highlights of a study that Battelle had completed on energy and transportation. The conclusion of the study was that an automobile can be built with existing technology and achieve an average of 80 mpg with a gasoline engine and 100 mpg with a diesel engine. However, this radically new automobile would not be built unless there were incentives other than current consumer demand to do so.

Because of the economic effect such an automobile would have on our whole country, it is not unreasonable that the incentive be provided by the federal government. Certainly, the whole country would be the beneficiary.

The United States has had a long history of providing incentives for innovation. Volume II of Nevin's Ordeal of the Union contains references to prizes and medals which served as a spur to 19th Century American inventiveness. In the 19th Century, fairs, exhibitions, and prizes played an important role in encouraging advances in technology and manufacturing. This tradition continues in the authority, for example, of the Administrator of NASA to make awards for contributions to aeronautical and space activities; the Nuclear Regulatory Commission to make awards for inventions or discoveries useful in the production or utilization of special nuclear material or atomic energy; and the authorization of cash awards for suggestions, inventions, or scientific achievements by military personnel.

We also have of course, the procedures followed by the Department of Defense in developing new military aircraft with a similar competition.

With these precedents, I propose that we provide an incentive to spur the development of the next generation of super-high mileage cars, and to make sure that an American manufacturer is the builder.

While Detroit is in the midst of investing its billions to produce automobiles in the thirty mile per gallon range, foreign competitors, who already have nearly thirty percent of the U.S. car market, are developing automobiles which will get more than seventy miles per gallon. Auto industry sources indicate Volkswagen designers are at work on a "Super-Rabbit" in the 75 mpg range. Volkswagen officials have said they hope to have this car ready for marketing in three to four years. Also, I understand that the Japanese believe we can develop such a car, but feel they are way ahead of us already.

We should provide an incentive for those in this country with engineering capabilities to design the automobile envisioned in this bill. Otherwise, Detroit might find itself once again five years late and billions behind, with the attendant damage to other American industries, employment levels, and the economy that this implies.

This proposed incentive is not a budget-busting item. It adds nothing to our near-term budget deficits. If the competitors do not meet the established criteria, this bill will cost the American taxpayer absolutely nothing. The private sector must risk its money first.

If the competitors meet the criteria, then this country will have gotten one of the best bargains in history. The cost would be, at most, \$20 million for each of up to four successful runners-up, and \$140 million to one winner. For that the U.S. auto industry and much

of the economy in general could be rejuvenated. The federal government's investment would be repaid many times over in jobs, expanded markets, and reduced energy dependence.

The Office of Technology Assessment's Staff Memorandum prepared for the Senate Commerce Committee on the companion bill introduced by Senator Stevens states "...in general the proposed legislation provides a good mechanism to promote the development of an automobile that could significantly reduce our economic vulnerability to imported oil. In addition the development of a very fuel efficient automobile is needed if the United States is not to be at a competitive disadvantage to other automobile manufacturing countries concerning such automobiles. The approach offered by this bill could provide an aggressive engineering and marketing test for such development without requiring that the federal government go directly into vehicle manufacture itself...Also, the proposal clearly was written with a keen sensitivity towards the issues that have been raised with respect to highly fuel efficient automobiles such as performance and carrying capacity. The specified criteria are sufficiently stringent to present a difficult engineering challenge, but we expect that prototypes meeting these criteria can be produced.

The Department of Energy's Conservation and Renewable Energy Division gave an unofficial but positive view on the bill by stating "...this incentive program for high technology development does not suffer from many of the problems of former incentive research programs."

Mr. Chairman, this bill provides American industry with a key incentive to develop a fuel-efficient vehicle that is far superior to anything now in use. I believe this is the only way we can effectively meet—in the next three to five years—the challenge posed by our foreign competitors.

Thank you.

Mr. GLICKMAN. Thank you, Mr. Shamansky.

You talked about analogies. Are there any other analogies that you can think of besides the ones that you mentioned?

Mr. SHAMANSKY. In terms of sheer dollar volume, the military is terribly significant. Once you mention one, you have mentioned all. We were searching for historical analogies, and that is the best one we have.

As a lawyer, I love precedents. I believe, Mr. Chairman, you are a lawyer too, and we always like to find precedents. That is the best one we found.

Mr. GLICKMAN. OK. Your bill basically provides for a contest to be established. In order to win the contest, you would have to meet certain criteria.

Mr. SHAMANSKY. Yes.

Mr. GLICKMAN. Like 100 miles per gallon, diesel; 80 miles per gallon, gasoline.

Mr. SHAMANSKY. Yes.

Mr. GLICKMAN. Four passengers and normal luggage.

Mr. SHAMANSKY. Yes.

Mr. GLICKMAN. With existing safety and environmental standards. There would not be any waivers on carbon monoxide or any of the other air pollutants.

Mr. SHAMANSKY. Right.

Mr. GLICKMAN. A service life of 100,000 miles and costing \$6,000 to \$6,500 in 1982 dollars.

How did you come up with all of these criteria?

Mr. SHAMANSKY. I obtained those criteria from the Battelle Memorial Institute, which is the world's largest private, nonprofit research institute. It developed the technology for xerography. I believe their volume of business is between \$300 and \$400 million a year. They got into this question by doing a study on the conservation of American energy. They saw the amount of oil being burned up in gasoline from our automobiles.

But Battelle researchers had the advantage of looking at it as a clean slate. They said, "Let's start from square one." These are the criteria that they developed, and of course Dr. Fawcett who, as I mentioned, is chairman and chief executive officer, is far better qualified to talk about this than I.

I should add that the president of Scientific Advances, Inc., a debenture capital arm of Battelle, is Charles G. James, who has been a friend of mine for many years. Our friendship goes back prior to the time he was associated with Scientific Advances. We have been discussing over the years the relative roles of automobiles—European, Japanese, and American—and the apparent failure of the American automobile industry to stay competitive in the fuel-efficient area. So that is how that came about.

Mr. GLICKMAN. OK. Now, what has Detroit told you about this bill?

Mr. SHAMANSKY. As you may remember, we held hearings and gave U.S. automakers an opportunity to testify. I think it was last July. I was hoping you would ask that question. Trying to summarize their attitude, I would say it seemed that they were sort of overwhelmed by it. They did not think it could be done, and certainly it was not the General Motors way of doing it, and it obvi-

ously was not the Ford way of doing it, and it obviously is not the Chrysler way.

I think basically their ways have been incremental. You make a 2-percent improvement at a time, and if it takes 25 years to make a 50-percent improvement, so be it. In the meantime, our competition is jumping ahead of us.

Mr. HARKIN. Would the chairman yield?

Mr. GLICKMAN. I would be glad to yield.

Mr. Harkin?

Mr. HARKIN. Mr. Chairman, if you would yield for a question—I just noticed that on the witness list we do not have any of the automotive companies—General Motors, Ford, or Chrysler. Is there a reason for that?

Mr. GLICKMAN. I was told that they declined to appear today to testify. I do not know the reason they declined.

Mr. HARKIN. You mean they were asked to testify?

Mr. GLICKMAN. It is my understanding that they have been asked to testify.

Mr. HARKIN. And they declined?

Mr. GLICKMAN. Yes.

Mr. HARKIN. They would not even come in and talk about it?

Mr. GLICKMAN. I think that is a fair statement.

Mr. HARKIN. Thank you, Mr. Chairman.

Mr. GLICKMAN. Let me ask you this: If Detroit shows no interest in such a competition—while I would fully expect that if the competition were held, they would show interest—if they did not show any interest, whom do you envision being able to successfully compete?

Mr. SHAMANSKY. I have spoken with Richard Celeste, who has a one out of two chance of being Governor of Ohio come next January, and I have suggested to him that the State of Ohio has a great interest in seeing the success of this venture. There are manufacturing firms—without naming them specifically—that have the expertise. I can mention companies that have it. Whether they will do it or not is another question.

TRW, which is an Ohio firm, is headquartered in Cleveland, and that is why it comes to mind. Our aviation companies—I can suggest that Beechcraft, for example, also has such expertise.

Mr. GLICKMAN. What if some company outside of the Midwest industrial heartland decides to compete?

Mr. SHAMANSKY. I think that would be marvelous. If somebody could work it out in the garage, fine. It is open to all American companies and individuals.

The whole object is to free this ability here and to tell someone, "If you will risk your money, you will have a chance of getting it back, if you believe that these criteria are achievable—and we have every reason to believe they are—you can win."

Mr. GLICKMAN. OK. Let me ask you just two other questions. Could you argue that this proposed competition would amount to a subsidy to U.S. automakers who are facing the challenge of a popular small, relatively fuel-efficient car?

Mr. SHAMANSKY. I cannot see any way that it would be a subsidy to automobile makers at all. Automobile makers have, in effect,

heretofore sort of thrown up their hands. They are about a generation behind.

Mr. GLICKMAN. Could it be viewed as a subsidy to whoever decides to make this car?

Mr. SHAMANSKY. Yes, if you say it follows our national policy of assisting initial, very high risk research, and that is what we have done consistently.

Mr. GLICKMAN. The intriguing thing about this is that it is an alternative to the option I see on the horizon, the "domestic-content" legislation or all sorts of trade barriers to limit the amount of foreign cars that can be sold in the United States. As you have pointed out with your windshield wiper blade or your TV radio, limiting foreign competition does not encourage innovation at all.

Mr. SHAMANSKY. I met Mr. Honda. I think in successive days, I met Mr. Robert B. Smith, chairman of General Motors, and I met Mr. Honda, who has the plant I mentioned in Marysville, Ohio. To say, as the AP article implies, they are not going to come in here—if there is a market, how can we assume they will not come in here?

Mr. GLICKMAN. Unless we restrict that market.

Mr. SHAMANSKY. Well that is possible—sure. That is, again, contrary to our long-term stated policy. There are newspaper articles now that state that the experts can see \$3-per-gallon gasoline coming back. The so-called oil glut is virtually gone now, and at least around Columbus the prices are going back up again.

Mr. GLICKMAN. OK. I have one final question, and then I want to turn to Mr. Dunn. I want to try to get some feel as to the total cost of your legislation to the taxpayers.

Mr. SHAMANSKY. If there are five successful competitors who meet the criteria, the four runners up they will each get \$20 million apiece. If it costs them \$19 million to do the research, they make \$1 million; if it costs them \$21 million, they lose \$1 million on that. The Secretary of Transportation would then determine the best of the five final competitors. The winner would get \$140 million to test market 10,000 units. There is no sense in having a prototype on the shelf. We have got to test market and see if the public would, in fact, buy it.

Mr. GLICKMAN. OK. Thank you, Mr. Shamansky.

Mr. Dunn?

Mr. DUNN. Thank you, Mr. Chairman.

You mentioned a 10-million car market—

Mr. SHAMANSKY. In 1973.

Mr. DUNN. And I suppose when you analyze that, and if you asked all 10 million people why they bought their automobiles, you would probably get 10 million different answers.

You mentioned personally that in 1978 you bought a Cadillac Seville and found all these things wrong with it.

Mr. SHAMANSKY. No; I did not say "wrong with it" at all. I just simply noted that the windshield wiper was no better than my old Ford's. I thought that was the state-of-the-art when in fact, Congressman Dunn, it was not the state-of-the-art; it was just what was available.

Mr. DUNN. I am curious as to why you purchased another Cadillac in light of the fact that in both 1978 and 1980 there were both

foreign- and American-built cars that had better fuel efficiencies than the Cadillac Seville.

Mr. SHAMANSKY. I am a true-blue American. I just thought I would buy American.

Mr. DUNN. But there are other American cars that offer significant energy savings over the Cadillac.

Mr. SHAMANSKY. I have no objection to comfortable cars. It is a feature of our market economy. If I am able to afford and choose to have a larger car, which I think has a safety factor—and I am a survivor of a head-on automobile accident, for which I spent over a year of my life in hospitals—and I know that there is greater safety overall in a larger car than in a small car. So my preference personally is for a large American car.

Mr. DUNN. Those are all good reasons. They are also very good reasons for GM to keep on making Cadillac Seattles.

Mr. SHAMANSKY. Yes; Congressman, I do not want you to misunderstand. I am not criticizing General Motors for making big cars. As long as there is a market and we have a free market economy, I want them to meet that market.

The point is that the United States is apparently losing out at the other end of the market to foreign competition. That is the problem. I have no objection to good-sized American cars. If you can afford it, buy it, and I hope you buy American.

Mr. DUNN. So, GM is doing some things right.

Mr. SHAMANSKY. There is no question about that. However, that is not the issue. The question is, as a national policy, are American companies meeting the foreign competition? I think it is safe to say, apparently not as well as they used to; I think that is a fair statement. Imports now take up 30 percent of our domestic market. We cannot wait until that figure reaches 50 percent or more.

Mr. DUNN. Yes; but we seem to be laying all the blame on the automobile companies.

Mr. SHAMANSKY. I am, in fact, saying that, if I wanted to buy a windshield wiper that would not accumulate ice, I could not get it from an American company. That is the bad news; the good news is that I cannot get it from a foreign company either. So, we have the chance of beating our competition by just thinking about our situation and utilizing available technology, if we keep an open mind.

Mr. DUNN. Following that rationale, if that particular idea is such a good idea—and it may be—if a 100-miles-per-gallon car is such a good idea, if the technology, as Battelle is going to testify, is available, why are they not doing it? I do not think you need that kind of Government subsidy.

If you or I could capture 60 percent of the automobile market, we would be pretty rich, would we not?

Mr. SHAMANSKY. Mr. Dunn, I can only point out to you the article from the professors in the Harvard Business School who are now going to plumb the psyches of our American business magnates to find out why we have not been doing so well.

I am not here to gage why we have not done something; I am reporting a fact, an objective fact, that they have not done it.

I used to own Chrysler stock. I bought it at 35 and sold it at 6. They were doing something wrong someplace—right? There is nothing magical about being an American automobile company.

Sometimes they have better times, and sometimes they have worse. Right now is not their greatest period.

I am pointing out objectively that this country faces a challenge, and I fear that we are about to lose it. Witness what Volkswagen is doing and Honda is doing, and we have a chance of freeing American expertise and not risking Federal money but encouraging the private sector to become innovative and productive again.

Mr. DUNN. My big concern is, will the market really accept this idea, and do you and I and Battelle have more wisdom than the combination of the Big Three? I suspect we do not; you suspect we do. I think it is terribly simple to look at another man's position and say, "I could do better than he." I doubt that we have that capability.

Mr. SHAMANSKY. Mr. Dunn, if I did not think that I could do better than the man I beat for this office, I would not be here. I make those value judgments all the time.

Mr. DUNN. We are talking about you and me versus GM.

Mr. SHAMANSKY. No; it is not a question of "versus GM." The assumption is that—

Mr. DUNN. The assumption is that, for 140 million dollars' worth of Government money, we can go in and beat GM.

Mr. SHAMANSKY. No, no; not at all. It says we can prove conclusively with the private sector risking its money that an American car can be developed to meet these criteria. That is extremely valuable national knowledge, and for the price of less than one bomber we can do that.

Mr. DUNN. Would you be amenable to an amendment to the bill that says the money is not disbursed from this grant, award, or whatever you want to call it—contest—until after the market has indeed bought the first 100,000 units of that car?

Mr. SHAMANSKY. One hundred thousand? I think that is not the point. The point is, of the five winning entries—assuming that you have five—you want to—I would not want anybody to build 100,000 if you could get a test market for appreciably fewer than that, which you can.

Mr. DUNN. No; but you are talking about disbursing money early. I am asking if you would be amenable to an amendment—

Mr. SHAMANSKY. I made a value judgment that this country, in competition with other countries should take the risk. It is a very cheap cost in view of the potential gain. It is a very good risk.

Mr. DUNN. But I am talking about after they have done it. Would you be amenable to that or not?

Mr. SHAMANSKY. No; I would not be amenable, because I think it would effectively kill off the program, and I do not want to kill off the program; I want to encourage the program.

Mr. DUNN. Thank you.

Mr. GLICKMAN. Mr. Harkin?

Mr. HARKIN. Thank you, Mr. Chairman.

Bob, again, as you know, I am very supportive of the legislation. I think it is a great idea, and I think it is something that would stimulate the imagination of a lot of entrepreneurs throughout the United States who have a lot of good ideas.

Quite frankly, regarding the competition and so forth, General Motors could qualify, could they not?

Mr. SHAMANSKY. I hope so—absolutely.

Mr. HARKIN. Ford could; they could all do it—right?

Mr. SHAMANSKY. Sure.

Mr. HARKIN. Along with others who might want to enter the fray.

Mr. SHAMANSKY. I hope so.

Mr. HARKIN. Your bill does not really speak to new technology. You left that up to—

Mr. SHAMANSKY. My bill assumes existing technology; that is the key.

Mr. HARKIN. OK. You know where I have been on this whole issue over the last several years, with my own Automotive Research Act.

Mr. SHAMANSKY. Absolutely.

Mr. HARKIN. And I think you have been supportive of that, too.

Mr. SHAMANSKY. Absolutely.

Mr. HARKIN. I see your bill as a very important step in really getting this country thinking about automotive technology and the next generation of automotive technology.

I believe right now that the Japanese and Europeans—mainly the Japanese—are working on the next generation technology.

Mr. SHAMANSKY. Absolutely; there is no question about that.

Mr. HARKIN. You are looking at Honda's 68-miles-per-gallon automobile. That is existing technology.

Mr. SHAMANSKY. Right.

Mr. HARKIN. They are going to move into a whole new area of technology in the next 10 years, and they are going to beat our pants off. They are already doing it with new types of engines—new technology engines.

What I am saying is that, not in any way to replace your legislation but as a parallel track, we ought to also be stimulating new technology along with the new designs.

Mr. SHAMANSKY. I am hoping that we will continue the research. I have been through the Lewis Research Center outside of Cleveland in which advanced research is being conducted. This bill should not be a reason to stop that kind of development at all.

Mr. HARKIN. To respond to my colleague, Mr. Dunn's question, why are they not doing it? I remember when I took a tour of Ford in 1977 or 1978.

Of course, as you know, I had a great interest in the Stirling engine and still do. I was interested in why Ford had dropped out of the contract with NASA at the time for the development of the Stirling. I went out and talked to a lot of Ford people. Basically, their response was that it was too long term, that there were too many technical problems inherent in the Stirling engine, and that they needed something more short term. What they were looking at at that time was the stratified charge engine that they were going to have in their 1981 models, I believe. They were supposed to have had them in their 1981 models; I have not seen them yet. I guessed they dropped the whole thing, but they showed me the engine and how it was going to work and everything.

Now, I guess what I am saying is that in viewing the big automakers, they have the same kind of—let us be frank about it; I will be frank about it—they have the same kind of bureaucratic inertia

that any big organization has, whether it is the Federal Government, or an automobile company, or whatever it might be.

Mr. SHAMANSKY. That is right; I think that is absolutely right.

Mr. HARKIN. It is bureaucratic inertia.

Mr. SHAMANSKY. Sure.

Mr. HARKIN. No one wants to make any mistakes, and it has to be cleared up the ladder. You get these engineers down there working, and well, they do not want to make any mistakes, and everything has to be cleared up the chain.

Yet I have seen smaller entrepreneurs, smaller companies of this country, take that Stirling engine and move in about 3 or 4 years to solve, maybe not all, but many of the technical problems that the Ford people told me would take 10 years to solve. I think it is because of this bureaucratic inertia. I think we have to recognize it for what it is, and that is why your bill, I think, sort of skirts around that and gets to a lot of these small entrepreneurs out there who have got good ideas and can do things.

I am not talking about backyard mechanics. I am talking about companies that employ 200, 300, 400, or 500 people, who can do this kind of work.

Mr. SHAMANSKY. Absolutely.

Mr. HARKIN. That is what we have got to get over. We have got to get over this thinking that, if General Motors, or Ford, or Chrysler does not do it, then it must not be worth doing.

Mr. SHAMANSKY. And I think that is the problem we have had. What I really regret is the feeling—well, I believe the other companies that have this engineering ability, who supply the automakers, are afraid to be seen, in a sense, going into that, which would be a shame, but that does effectively eliminate a lot of potential developers or utilizers of the existing technology.

That is why this is meant to provide an incentive for those who do not have that kind of a deterrence.

Mr. HARKIN. You do envision that there would be a lot of smaller companies throughout the United States getting involved?

Mr. SHAMANSKY. We hope so—absolutely.

I just want to make sure that no one thinks this is directed against the automobile companies. They are qualified to enter, also.

Mr. HARKIN. Sure, they are. If they come up with it, they can win—right?

Mr. SHAMANSKY. Sure.

Mr. HARKIN. And you would think they would have the big advantage.

Mr. SHAMANSKY. I would think so.

Mr. HARKIN. Except for the bureaucratic inertia that is involved in those companies.

Mr. SHAMANSKY. Yes.

Mr. HARKIN. Again, to repeat myself to make a point, while I am supportive of the legislation and will do everything I can to see it pass, I also do not want to lose sight of the fact that we must do everything we can to push for the next generation of technology.

Mr. SHAMANSKY. Absolutely.

Mr. HARKIN. It is coming, and it will be the kind of thing that will capture the imagination of the people. It will be more efficient, probably last longer, and people will want to own it.

You know, when the first Hondas started coming to this country, except for being smaller, they were not really all that different from American cars. They had radios, power steering, and automatic transmission. They were not that different, but they captured the imagination, because they did incorporate some new down-sized technology, and I think that is what the next generation is going to be. It is going to be new engines; whether it is turbine engines or Stirling engines, I do not know—one of those perhaps—new drive trains, new gearing mechanisms—all kinds of new technologies that are going to make those automobiles much more efficient.

So, we seem to limit our concept of how far we can go. We look at Hondas—68 miles per gallon. You are talking about 100 miles per gallon. We say, well, that is the limit; that is it; we can go no farther. Well, we both know that that is not the case.

Thank you very much.

Mr. GLICKMAN. Thank you, Bob. We appreciate your testimony.

Mr. SHAMANSKY. Thank you, Mr. Chairman.

Mr. GLICKMAN. I am going to ask you to chair part of the hearing today, if you do not mind.

Mr. SHAMANSKY. I will be very objective about the whole thing. [Laughter.]

Mr. GLICKMAN. Our next witness is, I suppose you might call him, the father of this idea. We will see how he describes himself. He is Dr. Sherwood Fawcett, chairman and chief executive officer of Battelle Memorial Institute in Columbus, Ohio.

Dr. Fawcett testified before our subcommittee in Detroit, I believe it was last summer. That is when the idea first was presented to us.

We appreciate your coming and look forward to your statement. You may feel free to either read it or summarize it—as you wish.

Without objection, your prepared statement will be included in the record.

**STATEMENT OF DR. SHERWOOD FAWCETT, CHAIRMAN AND
CHIEF EXECUTIVE OFFICER, BATTELLE MEMORIAL INSTITUTE,
COLUMBUS, OHIO**

Dr. FAWCETT. Mr. Chairman, I thank you very much for this opportunity to appear here today on behalf of Battelle Memorial Institute to comment on H.R. 5880, the Automobile Research Competition Act.

As has been mentioned before, Battelle is a large, independent research institute engaged in contract research and development for industry and Government. We have, on our own account, for some time been investigating the feasibility of a vehicle of the type envisioned by H.R. 5880.

I have prepared a rather detailed written statement for the subcommittee giving the reasons I believe it is important for the Nation that the proposed H.R. 5880 become law, but I will simply summarize this at this time.

First off, I enthusiastically support not only the goals of this bill but also the means contemplated to achieve them.

The primary thrust of H.R. 5880 is to stimulate American industry to rapidly develop, manufacture, and market a truly fuel-efficient, safe, and low-cost automobile that will be competitive with models under consideration in foreign countries.

This proposed legislation, which very closely follows, as we mentioned, a suggestion I made in testimony before the subcommittee at its hearings in Detroit last July 7, would have two important effects if enacted: First, it could result in greatly reduced oil consumption by automobiles in the United States in years to come, perhaps by half as much oil as we now import; that, despite the present and very temporary oil glut, is of far-reaching importance.

Second, the legislation, if enacted, would give the United States the chance to reestablish its position of leadership in the automotive world and to recover its former share of the auto market.

Regarding this second point, the bill does indeed favor American industry. As written, only United States entities are eligible to participate, and not more than 25 percent of the cost of manufacture of each automobile can be for the manufacture or assembly of parts made outside of the United States.

The cost to the U.S. Government for successful attainment of the specifications in the act is between \$140 and \$220 million, a relatively small sum when one considers the benefits it has purchased.

On the other hand, if the criteria of the competition are not met, then the cost to the U.S. Government is zero. Thus, the Automobile Research Competition establishes a risk-free mechanism for the U.S. Government to induce further research and actual development of low-cost, fuel-efficient automobiles in this country such that United States preeminence in the automobile industry can be reestablished.

Recently, Battelle Memorial Institute undertook an internally-funded study on the feasibility of developing a low-cost, highly efficient personal transportation vehicle as an alternative to the current automobiles and future ones that appear to be under development. Performance criteria given in section 4 of H.R. 5880 were specified as a design target in the study. A 3-year development time was assumed to make certain that the research team limited itself to present state-of-the-art materials, manufacturing techniques, and design practice.

The conclusion of the team was that there is no technological reason that we cannot develop and produce such a vehicle. The manufacturing cost estimate, however, carries considerable uncertainty and requires further study.

The result of the study was a design concept for a highly fuel-efficient sedan capable of carrying four adult passengers and their luggage in over-the-highway service. While not a commuter car per se, the conceptualized vehicle also would be efficient and economical in commuting and in short-trip service.

The vehicle would be conventional in its overall arrangement; it would have front-wheel drive; and its acceleration performance would be sufficient to allow it to mix safely with current traffic patterns. The body would be highly streamlined, with smooth exterior features, particularly on the underside.

At this point I want to emphasize that the vehicle conceptualized by Battelle is not—repeat, not—a mini or even a subcompact-sized

car. I would like to show from posters here that the study car outlined in red [indicating]—is compared in this case with a composite of current compact and subcompact cars.

You can see here that it is significantly longer and higher than the composites of typical present-day compacts. Even when you compare this with a composite of recent intermediate cars [indicating]—that is the same outline in red compared with the composite of intermediate cars such as the X body, the K body, and so forth—the study car—again, shown in red—compares favorably with those cars.

The greater length of the body would provide room for luggage; and, more importantly, it would result in more benign decelerations during crashes. We spent a lot of time worrying about the safety of this design car.

Predictions of the potential fuel economy for the Battelle study car were made by a combination of approaches under a variety of circumstances. The results of our study, including a factor for conservatism, indicate that a gasoline version of the contemplated vehicle would achieve 80 to 85 miles per gallon in the EPA urban cycle and in the 55-miles-per-hour cruise mode, and that a diesel version would achieve 100 to 105 miles per gallon in these same categories.

The important factors which contributed to the high miles-per-gallon projections are a combination of things; no one factor does it; it is a combination. These factors, in order of decreasing importance are, first of all, the body weight reduction.

Our study considered an all-aluminum body, which has an estimated weight of 450 pounds and which yields a total vehicle weight of about 1,200 pounds. Later on the designs might incorporate a combination of aluminum, reinforced plastic, and steel, to optimize for weight reduction and low manufacturing costs.

Even though lightweight cars often are associated with poor safety performance, our study designed the vehicle with safety in mind. Considerable attention was given to crush distances between the bumpers and the passengers, as noted earlier, to passenger restraint systems, to the structural competence of the passenger section, and to other design details.

At this point I might add that, if you looked at this car that Congressman Shamansky talked about from Honda, you would find that there is very little distance, and that this is really, in my opinion, somewhat dangerous when you consider that in these very small cars no effort has been made to take safety into account.

I think that if these kinds of vehicles—these so-called microvehicles—would be introduced, we would see the statistics—safety statistics—going against us very fast.

Another item we looked at very carefully was aerodynamic drag reduction. Here we assumed an aerodynamic drag coefficient of .25 in conjunction with a frontal area of about 10 percent less than on current four-passenger cars. This can reduce the aerodynamic drag by 44 percent, thereby significantly increasing gas mileage.

You might question whether this was achievable or not. I would like to call your attention to seven research vehicles recently tested in Europe. These vehicles—and I will show them on the poster here—indicating—had an average aerodynamic drag coefficient of

.253, which tends to confirm the reasonableness of our .25 assumption.

You can see that they are not bad looking vehicles; they are not necessarily small, but they are very well streamlined.

The third point was the reduction of engine size, with intermittent supercharging. It is desirable to reduce the engine displacement, not only to reduce its weight but also so that the engine can work at higher specific loads and therefore higher thermal efficiency during the various driving cycles. Engine size is reduced through decreased vehicle weight, by lower acceleration capability, and by employment of a continuously variable transmission.

Use of engine supercharging also effectively reduces required engine displacement. Our study evaluated a supercharged engine which is sufficiently large that it does not demand boosting during the urban driving cycle. The engine was sized to yield minimum fuel consumption at cruising power levels. Boosting is required for higher levels of acceleration and for hill climbing.

The fourth thing we did was to use this continuously variable transmission—we call it a CVT—controlled by a microprocessor. It offers two significant advantages: First, the CVT allows the engine to operate at the particular speed at which a given power requirement can be met with the least amount of fuel consumed. Second, gas-saving gear ratios, like overdrive, can be achieved without transmission complexity.

We have been conservative with regard to the fuel economy projections related to the CVT since only about half of the fuel economy gain claimed by others was used.

The fifth point is that we used a flywheel for braking energy conservation. There is general agreement that approximately one-third of the fuel used in typical urban cycle driving is wasted in the braking process. Our study exploited this by providing a small flywheel in the transmission. Energy is delivered to and from this flywheel by a second steel V-belt under microprocessor control. A well designed system can recover about 65 percent of the braking energy now lost. Somewhat less than this was assumed in the fuel economy projections in an attempt to be conservative.

Finally, we used some other factors in the study. Among others were reduction of the rolling resistance from tires and reduction of the accessory load through design considerations.

It was difficult to estimate the manufacturing cost or selling price at this technical feasibility stage. The approach which was used consisted of scaling from detailed cost data available in a Government report on a 1975 high-volume U.S. sedan. In this scaling, the body costs were isolated and multiplied by a factor of two, which reflected the use of half as many pounds of aluminum as steel, but then the aluminum is four times as expensive per pound.

Also, this scaling reflected materials, size effects, complexity, and weight; factors for inflation, manufacturing volume, and labor costs were applied.

This resulted in a selling price in the range of \$6,500 to \$7,500. With this selling price goal, if you assume a dealer markup of 22 percent and a corporate overhead and profit of 100 percent, the variable factory costs range to produce the car in mass production is around \$2,664 to \$3,074.

There is significant evidence that the American public greatly desires the production of this type of automobile. A consumer attitude survey commissioned by Battelle concluded that the basic concept—an innovative, fuel-efficient, and low-cost vehicle—has substantial consumer appeal.

The survey concluded also that this conceptualized vehicle is favored over three other types of vehicles expected to be representative of the competitive environment at the time the vehicle might be brought to market.

Also, we are aware of over 100 newspaper articles and editorials concerning this concept that have appeared since the Detroit hearings last year and most of them comment favorably on the use of Government incentives to help bring an American fuel-efficient vehicle rapidly to the market.

In addition, we have received countless letters and calls from individual citizens requesting more basic information, wanting to place an order, and even wanting to come and work for us.

In view of the tremendous need for a low-cost, fuel-efficient vehicle of this kind, the technical feasibility of its production, and the great consumer appeal that has been demonstrated, Battelle conducted a campaign to obtain investors in a research and development limited partnership to fund the development of the proposed vehicle. In the United States we approached three major automobile manufacturers, four major oil companies, three automobile suppliers, three insurance companies, a national car rental company, two investment bank houses, and two major foundations.

These organizations, although they were enthusiastic about the proposal, in general did not want to invest in a front-end R. & D. program of some risk when the payback would require a much larger additional investment containing all the uncertainties inherent in the manufacture and marketing of a new, innovative product in the automotive field. There did not appear to be sufficient incentives for them to take investment risks.

It is my conclusion from these contacts, as well as from other letters, presentations, and discussions, that it is unlikely that there are risk-capital funds available from traditional sources in the United States of the amount needed to undertake a development program of this size without some additional incentive or risk-reducing mechanism.

The present state of the U.S. automobile market and the commanding lead of the Japanese and European auto producers makes this area of investment very grim indeed.

However, H.R. 5880, when enacted, will change the investment outlook of this situation. An investor in a development program can then view the risk in terms of the chances of technically developing a vehicle to meet the requirements of section 4 of the bill.

If these requirements are met, the investor has four chances of at least getting his initial investment back and one chance of winning the competition, thereby allowing him to obtain considerable assistance in the costs of tooling up for production.

Thus, from the beginning of the development program, the investor can see the possibility of a successful launch into the manufacturing phase and a return on his investment. I believe this will make all the difference.

In conclusion, I would like to note that the U.S. automotive market is the largest in the world because of the prosperity and size of our great country, but 1979 was the last year in which the United States was the largest manufacturer of automobiles.

I urge Congress and the administration to take steps to regain our leadership in the automotive area. I believe H.R. 5880 is one such step for leapfrogging ahead of the foreign competition and toward oil self-sufficiency for this Nation.

[The prepared statement of Dr. Fawcett follows:]

STATEMENT OF DR. SHERWOOD L. FAWCETT
CHAIRMAN AND CHIEF EXECUTIVE OFFICER
BATTELLE MEMORIAL INSTITUTE
AT
HEARINGS BEFORE THE HOUSE SUBCOMMITTEE
ON TRANSPORTATION, AVIATION, AND MATERIALS

Washington, D.C.
June 15, 1982

Mr. Chairman:

Thank you for this opportunity to appear here today and to comment on HR 5880, the "Automobile Research Competition Act". I want to state at the outset that I completely and enthusiastically support this Bill as necessary and desirable for stimulating American industry to develop and market a truly fuel-efficient, safe, and low-cost automobile for the American public. This proposed legislation, which very closely follows a suggestion I made in testimony before the Subcommittee at its hearings in Detroit last July 7, would have two important effects if enacted. First, it could result in greatly reduced oil consumption by the automobile in the United States in years to come—perhaps by half as much oil as we now import. That, despite the present and very temporary oil glut, is of far-reaching importance. Second, the legislation, if enacted, would give the United States the chance to reestablish its position of leadership in the automotive world. Having said this, I will leave it primarily to others to comment in more detail on the significance of HR 5880 to the national economy, security, and quality of life.

**A Vehicle Meeting the Proposed Specifications can
be Developed With Present Technology and Within
the Proposed Competition Time Schedule**

Recently Battelle Memorial Institute undertook an internally funded study on the feasibility of developing a low-cost, highly efficient personal transportation vehicle as an alternative to the current automobiles and future ones that appear to be under development. Performance criteria given in Section 4 of HR 5880 were specified as a design target in the study. A three-year development time was assumed to make certain that the research team limited itself to present state-of-the-art materials, manufacturing techniques, and design practice.

In conceptualizing such a vehicle, the project team was required to establish that there was a reasonable likelihood that each design criterion could be met or exceeded. The conclusion of the team was that there is no technological reason that we cannot develop and produce such a vehicle. The manufacturing cost estimate, however, carries considerable uncertainty and requires further study.

The result of the study was a design concept for a highly fuel-efficient sedan capable of carrying four adult passengers and their luggage in over-the-highway service. While not a commuter car per se, the conceptualized vehicle also would be efficient and economical in commuting and in short-trip service. The vehicle would be conventional in its overall arrangement, it would have front-wheel drive, and its acceleration performance would be sufficient to allow it to mix safely with current traffic patterns. The body would be longer than many recent compact and subcompact cars, and would be highly streamlined with smooth exterior features, particularly on the underside. The greater length of the body would provide room for luggage, and more importantly, result in more benign decelerations during crashes.

It is important to reiterate that this conceptualized vehicle is not a mini or even a subcompact size. Figure 1 shows an outline of its overall size compared with that of typical present-day subcompacts and with recently introduced intermediate size automobiles. Note that it compares in length and height to a GM X-car or Chrysler K-car but is somewhat narrower. It is not necessary and definitely not desirable to downsize an automobile to reduce its weight.

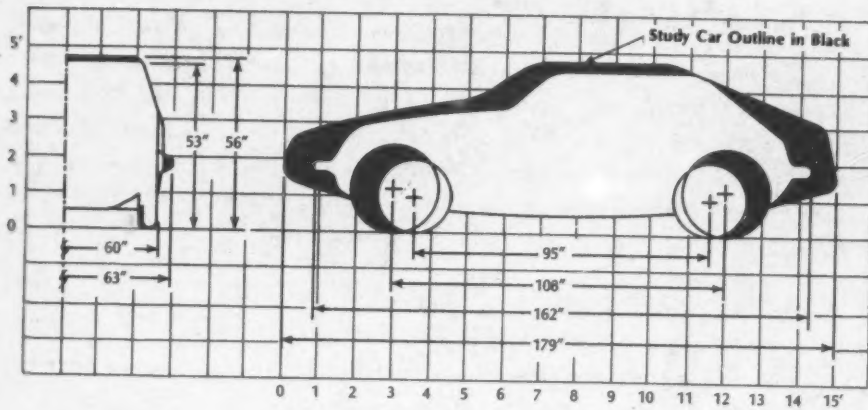
Predictions of the potential fuel economy were made by a combination of approaches. Calculations were made for 55 and 65 miles per hour steady-state cruise conditions. The EPA urban driving cycle was computer modeled for the gasoline version, with and without a flywheel. In addition, projections were made for both the EPA urban and highway cycles by parametric scaling from an existing car. These results were weighted, and a factor of conservatism was applied, yielding the following estimates of miles per gallon:

	<u>EPA Urban Cycle—With Flywheel</u>	<u>EPA Urban Cycle—No Flywheel</u>	<u>55 MPH Cruise</u>	<u>65 MPH Cruise</u>
Gasoline Version	80—85	67—72	80—85	60—65
Diesel Version	100—105	85—90	100—105	75—80

Our study was limited to the use of near-term technology in order to provide for prototypes in a three-year time span. No new types of heat engines or new materials were considered. Instead, the project combined existing or near-term technology in a conceptual feasibility study to determine feasibility limits for fuel economy. Important factors which contributed to the high miles-per-gallon projections, generally in order of decreasing significance, are:

Reducing Body Weight—Reducing body weight allows savings in the engine, the transmission, and in the suspension and running gear. An aluminum body was evaluated to determine the potential for significant weight reductions. A 450-pound estimated body weight resulted, including glazing, insulation, and bumpers, giving a 1200-pound total vehicle weight. The skin, of .040-inch aluminum, consisted of an internal and outer skin in most places. The body was

**BATTELLE STUDY CAR VERSUS COMPOSITE OF EIGHT
CURRENT COMPACT/SUBCOMPACT CARS**



**BATTELLE STUDY CAR VERSUS COMPOSITE
OF RECENT INTERMEDIATE CARS**

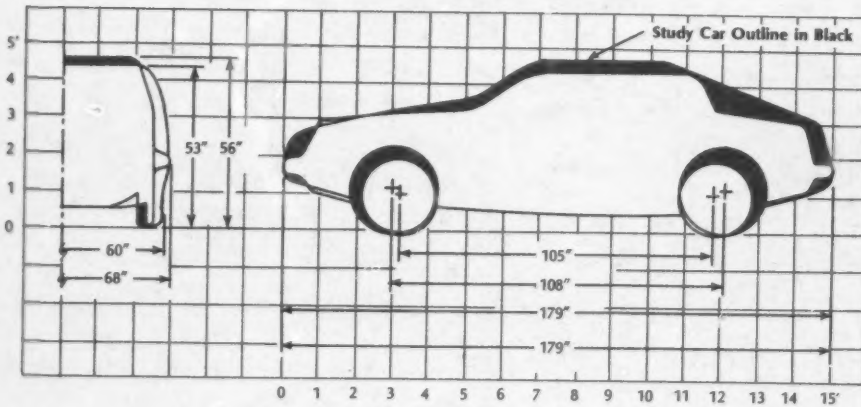


FIGURE 1

about 15 feet long, 5 feet wide and 56 inches high. Included was a structurally competent center section to surround the passengers in a crashworthy manner, and substantial zones, both fore and aft, for crushing in a crash. Alternative body designs could incorporate a combination of aluminum, reinforced plastic, and steel to optimize for weight reduction and low manufacturing cost.

Although there are data indicating that reduced automobile weight decreases safety performance, particularly with regard to two-car crashes, we believe that safety can be maintained at adequate levels with proper measures. For instance, in our study, safety was furthered by new safety design details, by the use of passive passenger restraint systems, and by the greater vehicle length, which provides more impact crushing distance.

Reducing Aerodynamic Drag—Comparisons of the technical results of research from around the world were reviewed and an aerodynamic drag coefficient of .25 was projected. Figure 2 shows seven research vehicles recently tested in Europe. These vehicles have an average aerodynamic drag coefficient of .253, which tends to confirm the reasonableness of the .25 assumption. A frontal area of 19 square feet is estimated. This area, about 10 percent less than that for current four-passenger cars, can be achieved primarily by reducing door thickness. A stiffening and strengthening rib added to the vehicle sides improves the side impact resistance lost by use of the thinner doors. The combination of reduced drag coefficient and reduced frontal area will result in approximately a 44 percent reduction of aerodynamic drag compared to that for typical current four-passenger compact cars.

Reducing Engine Size With Intermittent Supercharging—It is desirable to reduce the engine displacement not only to reduce its weight, but also, the engine can work at higher specific loads, and, therefore, higher thermal efficiency, during the various driving cycles. Required engine size is reduced through decreased vehicle weight, by lower acceleration capability (0–60 mph in 19 seconds when fully loaded), and by employment of a continuously variable transmission (CVT). Engine supercharging also effectively reduces required engine displacement. Our study evaluated a supercharged engine which is sufficiently large that it does not demand boosting during the urban driving cycle (EPA). The engine was sized to yield minimum fuel consumption at cruising power levels. Boosting is required for the higher levels of acceleration and for hill climbing.

The engine weights were estimated by "classical" scaling from known weights of existing automotive gasoline and diesel engines. (In "classical" scaling, all dimensions are kept in proportion, and the speed is increased by the same factor that dimensions are decreased.) The small,

Aerodynamic Drag Coefficient (C_D) of Recent European Research Cars

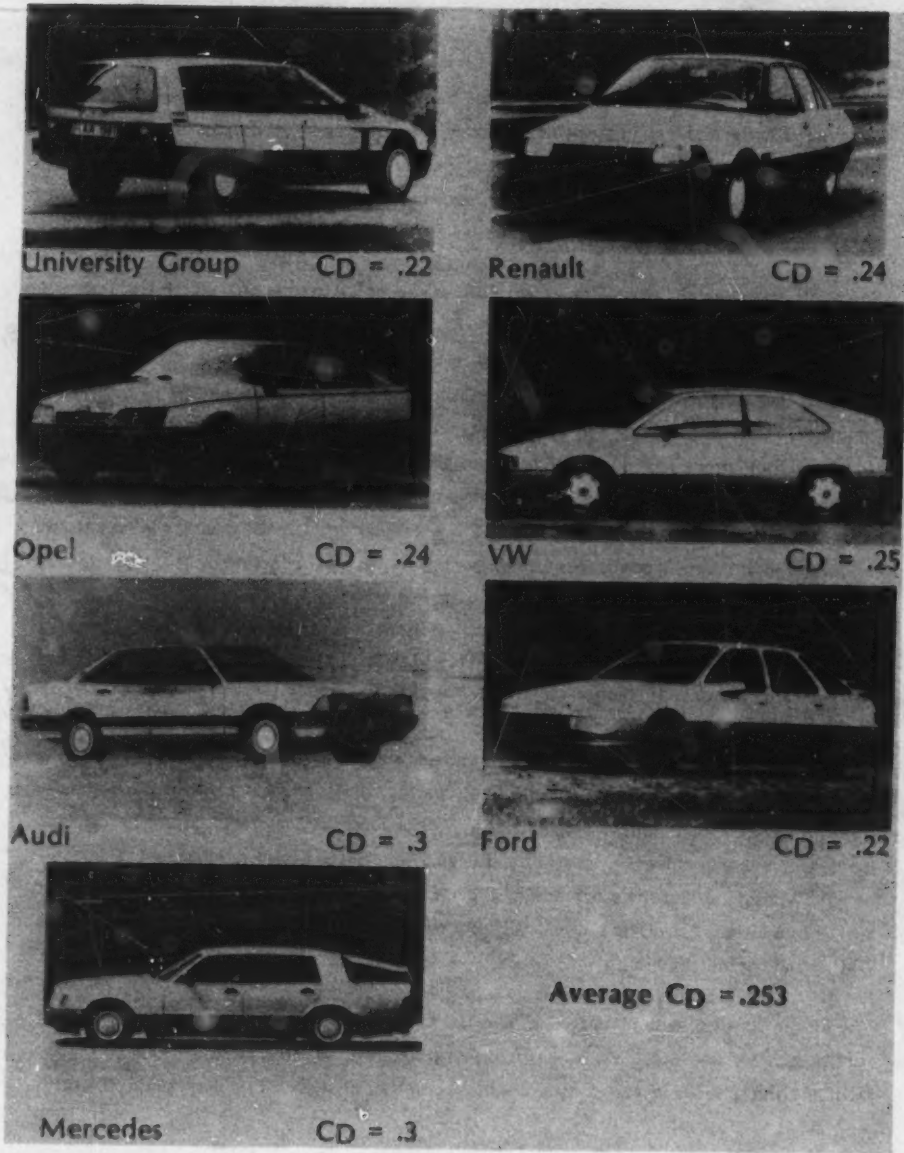


FIGURE 2

intermittently supercharged engine will operate at higher average cylinder pressures over its lifetime, and some "quality" features, not typical of automotive gasoline engine practice, may be required in order to achieve the 100,000-mile life. Both the gasoline and diesel engines are assumed to have essentially the same specific fuel consumption as the best of their current larger automotive counterparts, i.e., a best point SFC of .46 lb/BHP_{hr} and .41 lb/BHP_{hr} for the gasoline and diesel respectively. The engine will be about one-half liter displacement.

Continuously Variable Transmission (CVT)—A CVT, controlled by a microprocessor, allows the engine to operate at the particular speed at which a given power requirement can be met with the least amount of fuel consumed. This approach — operation along the minimum specific fuel consumption line — is illustrated in Figure 3. This strategy is not new to automotive engineers, but it is only in recent years that a practical and economical CVT, the steel V-belt CVT, has evolved. In our fuel economy projections, we have been conservative with regard to the merit of the CVT since only about half of the fuel economy gain claimed by others was used. In addition to allowing operation at minimum specific fuel consumption, the CVT makes it practical to obtain higher gears (overdrive) without an unduly complex transmission. Also, the CVT allows the engine to more fully produce its maximum power during "wide-open throttle" accelerations. This is illustrated in Figure 4.

Flywheel for Braking Energy Conservation—There is general agreement that approximately one-third of the fuel is wasted in braking in typical urban cycle driving. Our study exploited this by providing a small flywheel in the transmission. Energy is delivered to and from this flywheel by a second steel V-belt under microprocessor control. In order for this system to be effective, it has to accept energy efficiently and return it to the vehicle efficiently. This steel V-belt CVT provides this capability. A well-designed system can recover about 65 percent of the braking energy now lost. Somewhat less than this was assumed in the fuel economy projections in an attempt to be conservative. The flywheel does not augment vehicle acceleration beyond that otherwise available from the engine. It only substitutes its energy for energy that otherwise would be available from the engine. This strategy avoids serious potential safety problems that might result from the driver anticipating an acceleration reserve from the flywheel and finding it unavailable in certain driving situations. A secondary benefit from the flywheel system is that it allows a convenient arrangement in which the air-conditioning compressor and the alternator operate at higher minimum speeds, and therefore allows them to be smaller and lighter.

Reduced Rolling Resistance Tires—The study assumed a tire rolling resistance of 8 lb/1000 lb of vehicle weight in comparison to about 10 lb for the best current practice. That assumption

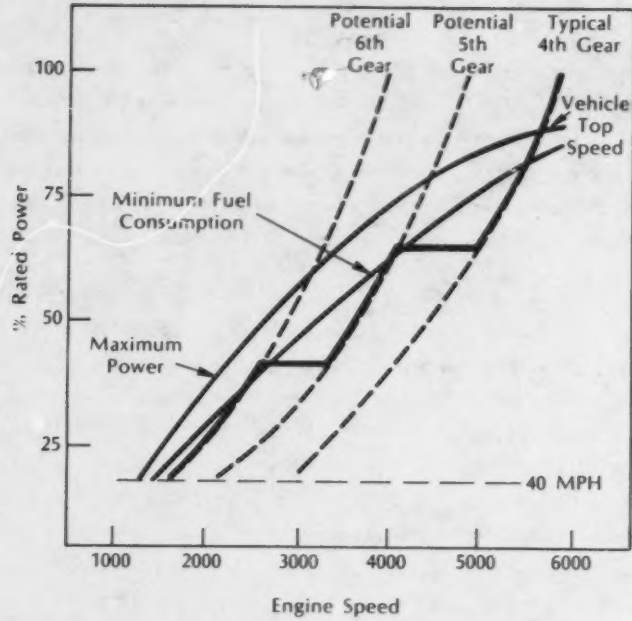


FIGURE 3. MINIMUM SPECIFIC FUEL CONSUMPTION OF A CVT VERSUS A STEPPED TRANSMISSION

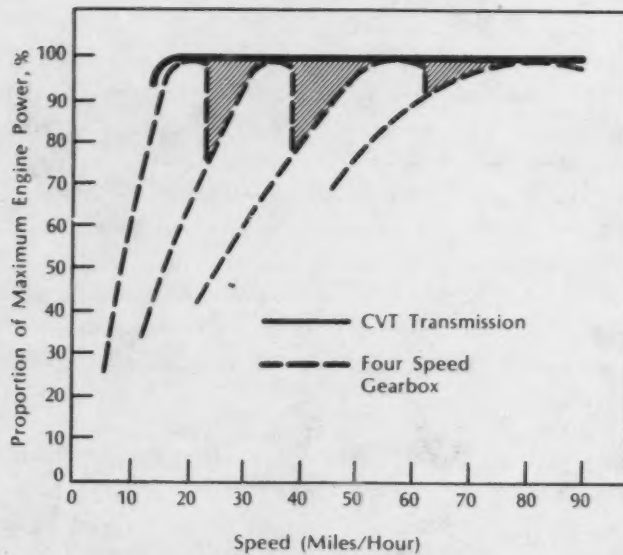


FIGURE 4. AVAILABLE ENGINE POWER FOR A CVT VERSUS A STEPPED TRANSMISSION

was based in part on a review of the technical literature which projected a potential gain to the 8-lb figure in the time frame of interest. Our study assumed that the current practice of low profile, small diameter tires can be altered to larger diameter, narrower tires with reasonable retention of styling and customer acceptance. All things considered, the 8-lb assumption is reasonably aggressive but not unrealistic. In addition, the sensitivity of fuel economy to tire rolling resistance is not as great as it is to vehicle weight, drag coefficient, or frontal area.

Reducing Accessory Load—By exerting careful discipline on accessory design, the daytime accessory load on the engine can be held to .3 HP. While an air-conditioning system is anticipated, its effect is not reflected in the estimated fuel economy numbers, since the EPA tests are conducted with the air-conditioner off. Likewise, the nighttime lighting load is not reflected in the EPA fuel economy numbers. The air-conditioning and lighting loads are difficult to scale down by the same ratio as the propulsion loads. Therefore, it is important to carefully engineer the air-conditioning and lighting loads so that the highest possible MPG is realized in actual practice and not just in EPA ratings.

It was difficult to estimate the manufacturing cost or selling price at this technical feasibility state. The approach which was used consisted of scaling from detailed cost data available in a government report on a 1975, high volume, U.S. sedan. In this scaling, the body costs were isolated and multiplied by a factor of two, which reflected the use of half as many pounds of aluminum as steel but with the aluminum costing about four times as much as steel per pound. Also, this scaling reflected materials, size effects, complexity, and weight. Factors for inflation, manufacturing volume, and labor costs were applied. This resulted in a selling price goal range of \$6500 to \$7500. For this selling price goal, assuming an estimated dealer markup of 22 percent and a corporate overhead and profit of 100 percent, the variable factory cost goal range to produce the car in mass production is \$2664 to \$3074.

The Public Will Buy Such a Vehicle at the Targeted Price

Concurrent with our technical feasibility study, an analysis of consumer attitudes was conducted by an organization specializing in market surveys. That organization interviewed 750 people, and its survey indicated that the conceptualized vehicle is favored over three other types of vehicles expected to be representative of the competitive environment at the time the vehicle might be brought to the market. The survey organization concluded "... that the basic concept — an innovative, fuel efficient, low-cost vehicle — has substantial consumer appeal ..."

The kind of positive press and public interest that the concept has generated since it was first described in July of 1981 also indicates that the public will desire to purchase the conceptualized vehicle once it is marketed. In this period, we are aware of almost 100 articles in newspapers and trade publications, most in American publications, but a few in foreign publications, concerning this concept and the government incentives program I proposed last year. Also, there are probably many more published stories that have not been brought to our attention. Further, there have been about three dozen editorials published, almost all of which comment favorably on a government incentives program to help bring a fuel-efficient vehicle to the market. Taken together this press coverage means that literally millions of people have had some exposure to the concept.

It is very difficult to say in a quantitative way what the radio and television coverage has been, but we have had supportive calls from the electronic media from one end of the country to the other. In addition, the press coverage has led to many inquiries from individual citizens and from representatives of industry. The letters and calls have run the gamut. We have had countless requests simply for more information. We have heard from a number of inventors and entrepreneurs indicating that they feel they have something to contribute to the development of a fuel-efficient vehicle. We have had people offer to invest their personal savings in the development. We have had people who are so excited by the concept that they want to know if they can come to work at Battelle. And we have had people who want to know if they can place an order for one.

All of this is a way of saying that we have seen real evidence that the public is very much interested in the development of a radically new automobile, and that it is anxious that we, as a nation, do what is necessary to get started now.

The Proposed Incentive is Necessary and Sufficient to Ensure Entries in the Competition

Over the past year I have conducted a campaign to determine the potential to obtain investors in a Research and Development Limited Partnership to fund the development of the proposed vehicle. For identification purposes, we named the project the Pertran Program. (Pertran was chosen as an acronym for Personal Transportation.)

In total, in the U.S. we approached three major automobile manufacturers, four major oil companies, three automobile suppliers, three insurance companies, a national car rental company, two investment bank houses, and two major foundations. The response of these organizations is best summed up in two sentences from one of them: "In directing attention to the energy efficiency of personal transportation, you are clearly focusing on one of the more critical aspects of the energy future . . . Consequently, while I sincerely offer you our best wishes for success in your Pertran demonstration project, I feel we must decline your offer to participate."

In general these organizations, for various reasons, did not want to invest in a front-end R&D program of some risk when the pay back would require a much larger additional investment containing all the uncertainties inherent with the manufacturing and marketing of a new innovative product in the automotive field. There did not appear to be sufficient incentives for them to take investment risks.

The Subcommittee may find it interesting that we have had contact with several Japanese automakers. We followed up these contacts with an effort to determine their interest in investment. Their informal response was to decline participation for the following reasons:

- They thought the proposed design goals could be met, but intended to develop new vehicle concepts themselves.
- They now have a commanding lead in the fuel-efficient automobile market and see no need to undertake a new development program at this time.

It is my conclusion from these contacts, letters, presentations, and discussions, that it is unlikely that risk capital funds are available from traditional sources in the U.S. in the amount needed to undertake a development program of this size without some additional incentive or risk-reducing mechanism. The present state of the U.S. automobile market and the commanding lead of the Japanese and European auto makers makes this area of investment very grim indeed. However, HR 5880, when enacted, will change the investment outlook of this situation. An investor in the development program can then view the risk in terms of the chances of technically developing a vehicle to meet the requirements of Section 4 of the bill. If these requirements are met, the investor has four chances of at least getting his initial investment back, and one chance of winning the competition, thereby allowing him to obtain considerable assistance in the costs of tooling up for production. Thus, from the beginning of the development program, the investor can see the possibility of a successful launch into the manufacturing phase and a return on his investment. This will make all the difference.

In conclusion, I would like to note that the U.S. automotive market is the largest in the world because of the prosperity and size of our great country. But, 1979 was the last year in which the United States was the largest manufacturer. I urge Congress and the Administration to take steps to regain our leadership in the automotive area. I believe HR 5880 is one such step toward leap-frogging ahead of the foreign competition, and toward oil self-sufficiency for this nation.

Dr. FAWCETT. I have with me today Mr. James Swain, who is manager of Battelle's automotive research program. He headed the study team. He will be glad to help me in answering any questions you might have.

Mr. SHAMANSKY [acting chairman]. Mr. Swain, if you would like to join Dr. Fawcett at the witness table, please go ahead.

Jim, since I have had at least an initial say, would you like to begin the questioning?

Mr. DUNN. I believe the intent of the bill is to spur research and development. Is that the intent of it?

Dr. FAWCETT. Yes. It is called the Automobile Research Competition Act.

Mr. DUNN. We have been critical of our own automobile industry. Let me, with all due respect to Battelle, be a little critical of your company. You are proposing a Government-subsidized program to the tune of \$140 million. I do not know how much money your company has personally spent on it. The end result will be a subsidized automobile that sells for—at a best guess—somewhere between \$6,500 and \$7,500, when the Japanese already have a vehicle capable of mass production that will sell for \$3,500. Does that not give you some concerns about your own company and your own research? The Japanese have already done it. Why do we not shut down Battelle and just go to Honda?

Dr. FAWCETT. I think that the Japanese have not already done it. They have not produced a 100-mile-per-gallon car.

Mr. DUNN. If you compare 68 miles per gallon at \$3,500 versus 100 miles per gallon at \$7,500 and asked the American public which car they would buy, you and I both know what the answer would be.

Dr. FAWCETT. I disagree, sir. I think you would have to look—again I go back to the size. If you look at the Honda city cars we are talking about, you find they are very tiny. They are some 3 to 4 feet shorter, for example, than we are talking about—what would be available as a result of this act.

This would make a significant difference in the amount of room and the amount of space that the passengers would have.

I think—and this may be a personal opinion—the American public has shown a reason to buy American cars when they could—buy larger cars when they could—because they did not like the very tiny cars. I do not think we are talking about the same thing.

Mr. DUNN. My point is still valid—that 5 years from now, when this first car rolls off the line, will we really be competitive with the Japanese? I have sincere reservations; you might disagree with me, but I have sincere reservations whether this car will be competitive with the Japanese.

Mr. SWAIN. I would like to make one comment about the Honda city car. While it is a very substantial engineering accomplishment, it is not a 68-mile-per-gallon car on the highway. Sixty-eight miles per gallon is a steady state cruise that happens to be at 37 miles per hour. The best projections we have seen on the Honda city car is that it is a car that would probably achieve about 60 miles per gallon on what corresponds to our EPA highway driving cycle and would probably achieve something like 50 miles per gallon on the equivalent of our EPA urban driving cycle.

I would like to make the important point that Dr. Fawcett made: It is not an equivalent of the Battelle study car; it is substantially shorter, and we, for instance, would have serious reservations about the safety aspects of a car that is both light and short mixed in the American motoring population. I do not think it is exactly what was suggested here.

Mr. DUNN. You are making the assumption then in the next 5 years that the Japanese will not do any more research. That is a pretty big assumption.

Mr. SWAIN. I was simply setting the record straight on what the Honda city car is and the point of view that it was the equivalent of what we are suggesting here; I do not think it is.

Mr. DUNN. Thank you.

Mr. SHAMANSKY. Mr. Harkin?

Mr. HARKIN. What I want to know is this: You have pointed out—it was in somebody's testimony here—that Battelle is the world's largest private, nonprofit research institute to develop xerography. If your study shows that a 100-mile-per-gallon car is feasible, why do you need Federal incentives? Why do you not just build some working models for sale to automobile builders or mass produce the car and sell it yourself?

Dr. FAWCETT. Congressman, if we had the money, we would not be sitting here today; we would already be 2 years down the line on this program. We just simply do not have the funds to be able to invest. As I pointed out in my testimony, we have tried very hard for the past year to get funds from other people, and we have not been successful. This is why we think this bill is very necessary, because in these days the risk is too high.

But as far as, why would not Battelle do it, we cannot afford it.

Mr. HARKIN. If this bill were approved, would you have a leg-up on everyone else, building this?

Dr. FAWCETT. To the extent that we have some very good people, we might have some advantage, but from the standpoint of almost anybody else in the automobile game, I would have to say no.

General Motors, Ford—our automotive people are very good people. As far as the technology goes, they have the technology. I think they would be very tough competition in this program. We would be coming from far behind in that sense.

Mr. HARKIN. What do you think the Japanese auto makers are doing that we are not? Why are they so successful? Can you just talk about that?

Dr. FAWCETT. There have been, of course, many articles and even books written about how the Japanese do it. In my opinion, as far as their manufacturing is concerned and their overall development in general, they have done about three major things that we have not quite adopted.

They do plan on a much longer basis; they see things over a longer timeframe, and they seem to be willing to make longer-term investments without seeing an immediate payoff. This goes back to how they do their financing.

They seem to also have made substantial progress in quality. As I understand it—in the 1950's they paid a great deal of attention to, as a matter of fact, an American professor in statistics who went over and taught them about the business of quality assurance

from the statistical standpoint. He was not very much listened to in this country, but they listened to him and, as a matter of fact, awarded him the highest medal—the Emperor's Medal or something—because they believed him and followed his advice. This is given great credit for their quality assurance program—their being able to, in a very economic way, find the areas where their quality is down and bring it up.

I do not buy the idea that their people are better workers than ours, but that is a personal matter. You know, I guess you can compare automotive wages and so forth and get your own ideas on how that goes, and from what I understand of the automotive industry, their wages are simply less than ours on a per-man-hour basis.

I do not think there is any big magic there. As a matter of fact, they are very competitive. It turned out that, after the hearings last July, we were contacted by some Japanese automobile makers with interest in what we had been doing. So we said, "Would you be interested in supporting us?" They came back and said no, but they had two interesting reasons; at least they are interesting to us:

First, they said, "We agree that the objectives that you talked about could be met, and when the time comes we will do it, but we have such a commanding lead in the fuel-efficient automotive market that we feel no need to put forth this effort now."

Mr. HARKIN. Was there something about the management structure also? Has Battelle ever studied their management structure in automotive companies?

Dr. FAWCETT. We have read some of the books, and we have a certain amount of contracts with Japanese industry. We are familiar with their consensus way of arriving at decisions. We find it to be slow and laborious in a way, but once a decision gets made they move very quickly.

Do you want to comment on that?

Mr. SWAIN. I have one comment with respect to things that are different. We do a substantial amount of automotive component development work for the U.S. automotive industry and for the Japanese industry as well.

One thing which seems to characterize the work we do for the Japanese is that they seem more willing to take a front-end risk and develop components that, on a value judgment basis, probably would be decided as being too risky in our environment here.

I think one element of what they bring to the automotive game is simply a risk-taking front-end posture to try to do some things that we declare to be too risky.

I am not faulting the automobile companies for that; that may be a product of many forces that are on them; it just seems to appear that way.

It is interesting that the only stratified charge engine in production in a passenger car anywhere in the world today is in the Japanese car—the Honda CVCC. The only Wankel engine in any substantial production anywhere in the world today is the Japanese car—the Mazda. I am not necessarily a proponent of either of those two things from a technological standpoint, but it is evidence of a risk-taking posture.

Mr. HARKIN. In the area of new technology, did your research go into different types of engines, or are you just satisfied with looking at the straight internal combustion engine that we now utilize—gasoline and diesel?

Dr. FAWCETT. In this particular study, we only looked at what was available at the present time. We did not want to postulate that certain new developments would be made. These were the ground rules of our study, so to speak.

Mr. HARKIN. OK.

Dr. FAWCETT. We looked at what was available. That does not mean that there should not be research into new engines and that in the future there should not be great advances. I think that if we can actually achieve the 100-mile-per-gallon type of vehicle with present-day technology, we should be able to move on and go much further with really new developments that would improve the efficiency of the engine, and so forth.

Mr. HARKIN. One last thing: You seem to really gear your interest toward a car—a universal car—that can be used for both city driving and highway driving, a car that is adaptable in both realms. Certainly that has been the thrust of American car makers, and Japanese car makers too, I might add. The Hondas are driven on the highways and in the city.

But are we not approaching in this country the norm of at least a two-car family? I do not know what the statistics show, but it seems that most urban dwellers, at least if they live in an urban environment where they do drive, have two cars.

And are we not seeing a process whereby more and more urban dwellers are getting one car for the city and one car if they want to go on a trip?

If that is the case, then why do we not look at a strictly urbanized car that is very fuel-efficient. Then we do not have to worry about the safety factor of driving on an open high-speed highway. We could concentrate on meeting that kind of market—a very low-cost, fuel-efficient urban car rather than one that is adaptable to both environments?

Dr. FAWCETT. The reason we ended up with the vehicle type that we did was this: We came at it originally from the standpoint of, how can we make significant fuel savings in this country. When you approach it that way, then you say, "Well, we have to work toward the idea that the U.S. automotive fleet has somehow got to be very much more fuel-efficient." So it is not enough to just pick one little part of the market; we picked a broad range.

We ended up feeling that, looking at the automotive family uses and so forth, the closer we could come to being an all-purpose vehicle, the better off we would be.

If you get started on this, there is a concept here—the idea of being really fuel-efficient—which could be applied once these things are developed. The idea of the flywheel, the idea of the microprocessors, and the continuously variable transmissions—these can be applied even to the kind of vehicles that Congressman Shammansky drives, with equivalent types of saving in fuel.

So I think we were pushing a concept here, and yet we approached the thing from the standpoint that it better not be too

costly, or a significant part of the public would not be interested in it.

Mr. SWAIN. We are not saying that there is not a market for a small commuter car or a strategy that employs more than one car to serve the total family's mission, but I think the market research of the automobile companies themselves would confirm the idea that there still is a very substantial market in spite of that for a car that is multimission and four- or five-passenger.

I think the largest single-market segment that is clearly identified is still the four-passenger multipurpose car, and it is at that largest single segment of the market that our study was aimed.

The other comment I would like to make is that there seemed to be an inherent implication in your statement about dual-purpose cars that the commuter car should be a small car, not necessarily a safe car, and the larger car that the family owned for travel between cities, and so forth, would be the safe car—the large car.

I think the accident statistics and data would tend to refute that argument. If you examine where people drive their cars most of the time and where most of the fatalities and accidents occur, I believe it would reinforce the idea that the commuter car needs to be a safe car as well, perhaps even safer than the over-the-highway car.

Mr. HARKIN. Thank you.

Mr. SHAMANSKY. Thank you, gentlemen, for your testimony.

May we call the next panel of witnesses: Mr. Michael Driggs, Deputy Assistant Secretary, Automotive Industry Affairs, U.S. Department of Commerce; and Mr. Michael Finkelstein, Associate Administrator, Research and Development, National Highway Traffic Safety Administration, U.S. Department of Transportation.

Mr. Driggs, would you like to begin?

STATEMENT OF MICHAEL DRIGGS, DEPUTY ASSISTANT SECRETARY, AUTOMOTIVE INDUSTRY AFFAIRS, U.S. DEPARTMENT OF COMMERCE

Mr. DRIGGS. Thank you, Mr. Chairman.

Good morning to you and to the other members of the subcommittee.

With Mr. Finkelstein and myself this morning is Dr. Richard Strombotne of the National Highway Traffic Safety Administration.

We appreciate the opportunity this morning to testify on H.R. 5880, the Automotive Research and Competition Act. This bill, if enacted, would establish a federally funded competition to encourage the domestic production of an automobile capable of achieving high levels of fuel economy. This vehicle would also be required to meet acceptable safety, environmental, and performance standards.

It is appropriate that the Commerce Department be asked to testify on this bill. The President has designated Commerce as the Agency responsible for coordinating administration policy regarding the automobile industry. To support this responsibility, the Office of Automotive Industry Affairs has been established.

The purpose of my testimony this morning will be to discuss the administration's policy toward the automobile industry. Mr. Finkelstein will comment specifically upon the bill.

The objective of the bill, as I understand it, is to insure that American manufacturers have a domestically produced high-mileage vehicle available to them should there be a market demand for the product in coming years. This is an admirable objective.

We believe, however, that the administration's program for the automobile industry as well as its policy for technology development could allow this objective to be met.

The key aspect of the administration's program for the auto industry is that it is noninterventionist, in line with the administration's overall economic philosophy. Our approach is based on three broad principles.

We concentrate our efforts on those activities which are under direct Government control or influence. Those areas in which Federal involvement would be ineffective, such as internal restructuring, are best left to management and labor.

We focus our efforts upon those programs which would have an immediate benefit for the industry but which would not handicap the long-term adjustments which must be made.

Our proposals are designed to help reduce the cost structure of the industry. It is only by lowering the relative costs of the products produced by the American companies that they will be able to charge a price that the American and world consumer is willing to meet, while still making a reasonable profit.

Based upon these principles, we have several specific programs. The centerpiece, of course, is the administration's economic recovery program. In the auto industry context, the key goal is to increase the size of the overall market. A business upturn is expected to occur around midyear and auto sales should increase also. Forecasts for total 1983 auto sales, including imports, are in the 9.5 to 10 million unit range, significantly higher than the 8.4 to 8.7 million forecast for this year.

Last year the President also identified 34 auto-specific regulations which should be amended or eliminated. Final action has been taken on about two-thirds of those regulations so far, and we expect action on most of the rest to be completed by the autumn. The result of this program will be a savings of over \$1 billion to the auto industry over a 5-year period and over \$9 billion to the consumers over the same period.

Another element of our program is represented by H.R. 5252, a bill to amend the Clean Air Act. It would return certain emission standards to the 1980 levels. We believe that this could be done without impairing the environment and will save the consumers \$100 to \$300 per car. We support passage of this bill.

Also of concern is the need to retain the safe harbor tax leasing provisions of the Economic Recovery Tax Act of 1981. In 1981 the industry's cash flow benefited to the extent of \$200 million from the safe harbor leasing rules. The companies have been looking forward to a \$300 million inflow this year.

While we recognize that there have been some abuses of these provisions, their use by the auto industry has produced the intend-

ed benefit, and we support retention of the rules with any adjustments necessary to correct clear abuses.

Finally, the administration strongly opposes local content legislation, as represented, for example, by H.R. 5133. This proposal would require that as much as 90 percent of the production costs of cars which a manufacturer sells in this country be domestic. Such legislation would be inflationary, restrict the industry's ability to seek the lowest cost sources of supply, impose a new regulatory burden on the industry, be a violation of the General Agreement on Tariffs and Trade, and hinder the industry's efforts to become internationally competitive.

In short, we do not believe that special assistance programs are needed by the American automobile industry.

The administration is, however, very deeply committed to technological growth. For this reason, the Economic Recovery Tax Act of 1981 has significant incentives for industrial R. & D. It provides, for example, a 25-percent tax credit on increases in direct R. & D. expenses, including equipment rentals, above a base period of the previous 3 years, even if the R. & D. is expensed in the accounting sense.

In addition, a company may receive a 25-percent tax credit on 65 percent of the total R. & D. expenses contracted out to universities and nonprofit institutions.

Companies are also eligible for a 3-year writeoff and a 6-percent investment tax credit on R. & D. equipment and machinery.

The combination of these tax incentives provides a high degree of leverage for any investment a company may make. For companies which do not pay taxes because of losses, the safe harbor leasing provisions I mentioned a moment ago would allow them to sell these tax benefits.

Over and above these incentives for increasing R. & D. in the Nation, the Office of Productivity, Technology, and Innovation at the Department of Commerce is implementing the Stevenson-Wydler Technology Act of 1980. Some of OPTI's long-term objectives, pursuant to the directives in the act, are to identify and remove barriers to innovation, encourage cooperative R. & D. ventures among domestic firms to undertake breakthrough research in key technologies, improve the flow and adoption of Federal technology by U.S. industry, and to improve patent licensing protection for U.S. Government innovations.

The administration's policies seek to create a climate supportive of research through increased cashflow and increased incentives. This will allow the marketplace to work and develop new technologies. This approach, we believe, is far more efficient and effective than attempts by Government to second-guess the marketplace.

The auto industry itself is presently involved in a massive program of research, development, and capital expenditure which is aimed at increasing the productivity of the industry and making the American cars more competitive all over the world. Although the industry still faces uncertainties, and the costs have been high, we believe it is on the right path.

I would note that our discussions with the automobile manufacturers and our independent analyses of the industry both show that research is now underway to produce more fuel-efficient cars

and alternate fuel cars. The path of this research is extremely sensitive to market trends, changes in technology, and overall world economic conditions.

We are concerned that legislation which creates a federally funded incentive for development of one specific vehicle, with a single efficiency measure, may distort investment in research from what the market would otherwise require.

Thus, while we applaud the intent of H.R. 5880, the Department of Commerce thinks that the President's economic program, if maintained, coupled with the industry's drive for innovation and productivity, will produce the kind of efficient, safe, and environmentally clean automobiles that Americans will buy.

Thank you very much.

Mr. SHAMANSKY. Thank you, Mr. Driggs.

If we may, we would like to have the testimony of Mr. Finkelstein, and then we can ask questions of you as a panel.

STATEMENT OF MICHAEL FINKELSTEIN, ASSOCIATE ADMINISTRATOR, RESEARCH AND DEVELOPMENT, NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION, U.S. DEPARTMENT OF TRANSPORTATION, ACCOMPANIED BY RICHARD STROMBOTNE, DIRECTOR, OFFICE OF AUTOMOTIVE FUEL ECONOMY STANDARDS

Mr. FINKELSTEIN. Thank you, Mr. Chairman.

I am Michael Finkelstein, the Associate Administrator for Research and Development at the National Highway Traffic Safety Administration. With me today is Dr. Richard Strombotne, the Director of our Office of Automotive Fuel Economy Standards.

We are pleased to appear before you today to discuss H.R. 5880, the Automobile Research Competition Act. The bill seeks, through incentives, to accelerate the development of very high mileage passenger automobiles in this country by American-owned companies. The incentive would be a maximum prize of \$140 million, awarded to the winner of an automobile development contest to be established under the bill and conducted by the Department of Transportation; \$20 million would be awarded as consolation prizes to four runners-up.

To be eligible to participate, a contestant would have to be an American-owned company and submit six identical prototype vehicles meeting a series of rigid minimum performance standards for fuel economy, travel load, acceleration, braking, and handling. The prototype vehicles would have to achieve at least 80 miles per gallon if gasoline-powered or 100 miles per gallon if diesel-powered, be able to carry at least 4 adults with luggage in highway service, and have a list price no greater than \$6,500 in 1982 dollars.

The contestant must also show the feasibility of domestically manufacturing and selling the prototype submitted at the rate of at least 100,000 vehicles per year for a minimum of 3 years.

This bill has been triggered, at least in part, by the continuing threat to the American automobile industry presented by foreign auto manufacturers. It is intended to encourage U.S. industry to put more advanced technology into production and thus to become more competitive in the marketplace.

While an incentive approach is preferable to the imposition of mandatory performance standards, the bill as drafted would place a contestant in an untenable risk position both financially and technically. We believe that the major flaws in the bill would discourage serious participation in the contest, dilute the incentive effect, and, thus, fail to stimulate the technological developments desired by the bill's sponsor. These concerns would take the following form:

Financial investment risks: Due to the continued sales slump in the U.S. automobile market, money for investment is tight. This bill would not provide investment capital to cover start-up costs. A contestant who made the preparations necessary for mass production would need initially to raise \$200 million to \$1.5 billion against the chance of receiving a maximum of \$140 million after the first year of production.

Even if such capital were available, the speculative nature of the investment and the possibility of eventual failure or achievement of only the consolation prize of \$20 million would make the opportunity cost prohibitive.

TECHNOLOGICAL RISK

While the technological components theoretically necessary to create a successful prototype exists, only one, the turbocharger, is in production. It is questionable whether the others could be developed successfully and manufactured within the 5-year lead time set by the bill.

In addition, the performance requirements are too rigid. Many current models with 35- to 45-mile-per-gallon fuel economy can neither achieve the acceleration that would be required of the 100-mile-per-gallon diesel vehicle nor satisfy the bill's detailed braking and handling criteria.

COST RISKS

Our analysis shows that it would be impossible to manufacture and sell the prototype vehicle at a reasonable profit for no more than \$6,500, as set in the bill. To cover costs and obtain a reasonable profit, the manufacturing list price would have to be several thousand dollars higher.

MARKETING RISKS

Aside from the technological issues involved and the threshold question of the price discussed above, we question whether an effective market will exist at that time. An automobile produced as a result of this bill would be on the market in approximately 1986 or 1987. Studies project that it would compete with a host of tested and proven 60-mile-per-gallon gasoline-powered automobiles.

We do not believe that the average consumer will want to pay an additional several thousand dollars for an 80-mile-per-gallon car with only marginal fuel savings over its 60-mile-per-gallon competition—on the average it will save 40 gallons per year—and whose quality, reliability, and safety attributes are unknown or questionable.

DRAWBACKS OF WINNING

The bill also creates an anomaly with respect to winners and losers. From a financial point of view, the real winners in this contest could be the four contest losers each awarded a \$20 million consolation prize. It is conceivable, although not likely, for a contestant to build six prototype vehicles that would meet the performance requirements for approximately \$10-15 million, collect the \$20 million consolation prize, and pocket the difference without commencing production.

The real loser could be the contest winner. In order to obtain the promised reward of up to \$140 million, the winner would have to manufacture and offer for sale 10,000 vehicles which will cost more than the maximum allowed price of \$6,500, and could result in a net loss which exceeds the prize money if production were to exceed 10,000 vehicles.

The winner may also find the vehicles hard to sell, because it may be unable to prove to the public the quality, reliability, and durability of the new technology used in them.

The contest incentive scheme as outlined in the bill presents broad policy questions on the best use of public and private funds to stimulate greater fuel efficiency in American automobiles.

Our analysis indicates that 60-mile-per-gallon gasoline-powered cars will be on the market in 1986 or 1987. The marginal value of an 80-mile-per-gallon car to be sold in competition with such vehicles would not appear to support additional Federal subsidies.

The automobile industry needed to make an investment of \$81 billion to raise new car fuel economy from 14 miles per gallon in 1974 to 32 miles per gallon by 1985 for an annual per-vehicle fuel savings of 400 gallons. That is, a 32-mile-per-gallon car saves an average of 400 gallons per year over a 14-mile-per-gallon car.

By contrast, raising fuel economy from 60 to 80 miles per gallon would only save an additional average of 40 gallons annually per car. To retool the industry to produce a new generation of cars that achieve 80 miles per gallon, yet offer marginal fuel savings, the auto manufacturers would have to invest many multiples of the \$81 billion figure.

The administration believes that market forces coupled with the substantial incentives for research and development and investment created under the Economic Recovery Tax Act of 1981 will provide U.S. auto manufacturers with appropriate incentives to bring fuel-efficient technology into production.

If it is technologically feasible to produce a car with the properties described in the bill at the price in the bill, that production would take place through normal market incentives. A \$215 to \$220 million Federal grant program, by itself, will not tip the balance and cause the auto companies to invest the billions needed to raise the fuel economy to 80 miles per gallon and will be counterproductive.

I do not believe that Federal funds should be spent in this area for development purposes. If demand for an 80-mile-per-gallon car materializes, the auto industry will have the incentive to invest the needed capital. Moreover, to the degree that such a form of external inducement might have some effect on resource expenditures

in future years, it could distort allocation decisions and strain financial markets through external Federal inducements.

In summary, I believe this proposal, although well intentioned, would not serve as an effective incentive for the American industry to invest in high technology beyond its current plans. With the tax law change in 1981, manufacturers already have the incentive and flexibility to invest in technology development based on their assessment of market potentials. A Government-sponsored incentive award program would be costly and counterproductive.

In addition, any vehicle resulting from this contest might have severe marketing problems due to the short lead time and inability to prove its unknown reliability, durability, and quality. I therefore oppose enactment of this proposal.

This concludes my statement. I would be pleased to answer any questions.

Mr. SHAMANSKY. Thank you, Mr. Finkelstein.

I do not mind telling you that I am quite touched by your respective faiths in the so-called National Economic Recovery Act, which really seems to be more—looking at the record—a National Economic Recession Act, in actuality.

Therefore, your testimony, for me personally, is colored by your apparent inability to distinguish between the hopes for the so-called recovery act and what it in fact delivers.

This is a sort of looking-at-the-record thing for me, thinking about the points you made.

May I ask, did either of you read the bill?

Mr. FINKELSTEIN. Yes, sir; I read it.

Mr. SHAMANSKY. You have read it? OK. Did you notice that, whatever you were saying about the behavior of any potential competitors assumes that the potential competitors would make up their minds as to whether or not they would choose to risk their money?

Mr. FINKELSTEIN. Yes, I did.

Mr. SHAMANSKY. Your testimony does not seem to acknowledge that.

Mr. FINKELSTEIN. I am sorry, but the bill, as we read it, clearly indicates that money only is awarded after the contract.

Mr. SHAMANSKY. OK. So, if these criteria could not be met, there is, certainly, no doubt in your mind that the Federal Government would not spend a penny; is that correct? Does either of you gentlemen have a problem with that?

Mr. DRIGGS. I think that is certainly a correct interpretation of the bill.

Mr. SHAMANSKY. OK. So, with all of the testimony—and so much of your testimony was ascribing to the contestants what they would be risking, and so on and so forth—actually, they would be risking their money—correct?

Mr. FINKELSTEIN. Only if they failed to produce six prototype vehicles that could meet the requirements.

Mr. SHAMANSKY. Are you saying it is your conclusion that, if five contestants met these criteria, there would be no value to the country, as such, to have demonstrated that five American manufacturers could, in fact, meet a vehicle with those criteria?

Mr. FINKELSTEIN. It is my opinion that, if five competitors demonstrated that they could develop prototypes that met the specifications in the bill, you would still not have evidence that there should be large-scale production of these vehicles. Further, it is not clear that the marginal improvement in fuel economy would generate in any meaningful demand for these vehicles to the point that it would be worth the kind of investments that the manufacturers would have to make.

Mr. DRIGGS. I would like to add one point to that, just to expand it. If the demand were there for the production of these vehicles, we believe there are already incentives in place that would allow and encourage American corporations to do the necessary research and the necessary development, and we are not sure that an additional incentive, quite frankly, would make that much difference.

Mr. SHAMANSKY. Mr. Driggs, is it your contention that the reason that the American automobile companies are in the financial shape they are in today is that there just were not enough incentives around for them these last 10 years?

Mr. DRIGGS. Unfortunately, there were too many incentives for them. Do not forget that 1978 was a banner year for the American automobile industry. They sold more cars and trucks than they ever had before, made phenomenal profits, and in December 1978 and January 1979 there was a world-wide shortage of V-8 engine capacity.

The incentives that had been built into the system were——

Mr. SHAMANSKY. Incentives, or was that not just a free market economy?

Mr. DRIGGS. The incentive was an unrealistically low price of fuel, which distorted the American consumer's preference to the point that the American market had a totally different standard than the markets of every other country around the world.

So, the American companies were responding to those incentives, whether they were intentional incentives or——

Mr. SHAMANSKY. Mr. Driggs, did you hear my testimony as to how many foreign units were sold in 1973?

Mr. DRIGGS. Yes.

Mr. SHAMANSKY. 1.7 million. Although it was only 17 percent, in absolute numbers it was 1.7 million units.

Mr. DRIGGS. That is correct.

Mr. SHAMANSKY. OK. So, in absolute terms, it was a lot of cars.

Mr. DRIGGS. Absolutely.

Mr. SHAMANSKY. And still the magical market did not work to carry on from that.

Mr. DRIGGS. I think the point is that this product would ultimately have to be produced, if it could be viable in the market, and the production technology, of course, resides amongst a fairly small number of firms.

Mr. SHAMANSKY. Is that true necessarily?

Mr. DRIGGS. To get the costs down, it pretty much is true.

Mr. SHAMANSKY. In other words, only three companies that you can think of—or four companies at best—in this country could produce an assembly line of vehicles?

Mr. DRIGGS. Without massive, massive investment costs, in effect to start from scratch and to build the assembly operations.

Mr. SHAMANSKY. Then perhaps they would not get into the contest.

Mr. DRIGGS. Perhaps not.

Mr. SHAMANSKY. Then there would be no expenditure by the Federal Government.

Mr. DRIGGS. But there is still the potential for expenditure by the Federal Government, because it is much less expensive to produce six prototypes that will meet the standards and recoup the costs plus a profit from the Government.

Mr. SHAMANSKY. And you think the country would suffer from the knowledge that these prototypes could be produced?

Mr. DRIGGS. I think the knowledge that prototypes could be produced is already there.

Mr. SHAMANSKY. Really? Which ones have produced it then? Are you telling me for sure that you know some companies that are going to produce those cars meeting these criteria? I mean, you have a degree of assurance which I have not been able to duplicate from anyone else, but go ahead.

Mr. DRIGGS. There is a semantic problem.

Mr. SHAMANSKY. A semantic one?

Mr. DRIGGS. I misunderstood your reference to "produced."

Mr. SHAMANSKY. OK.

Mr. DRIGGS. I think there is a widely held belief that it is technologically feasible to design such a car. There is a great deal of question on whether or not it can be produced at the costs that would be included.

Mr. SHAMANSKY. Then maybe you would suggest that we raise the price a little bit in order to achieve that; I do not want to be unrealistic. The figures were not just drawn out of a hat; we are just trying to be realistic.

Mr. DRIGGS. I understand.

Mr. SHAMANSKY. If you have some evidence on that—

Mr. DRIGGS. I am suggesting, sir, that there is really a principle here, and that is that when the Federal Government tries to design a product through legislation by giving very specific standards, we in effect are distorting the marketplace and the development that otherwise would occur.

Mr. SHAMANSKY. The Government has no role in any kind of a development process?

Mr. DRIGGS. Not at all. In fact the Government does have a role in encouraging development, and we are suggesting that the role has already been fulfilled and that incentives already exist out there, so that if there is a demand for the product, it will be produced.

Mr. SHAMANSKY. OK. The faith of this administration in the market is, to me, something to behold; it truly is.

Getting testimony from the Secretary of Energy, I have been fascinated that a tremendous exception is made for the production of electricity from nuclear. Somehow or other, none of the rules apply to that. It is a fascinatingly selective sort of a process.

If I may ask you—on page 3 of your testimony, Mr. Driggs—"The elimination of 34 regulations"—are you saying that the foreign competition will benefit from the release of—the cancellation of

these regulations, so therefore the competitive advantage may still be to them, as distinguished from our American companies?

Mr. DRIGGS. They will benefit to some extent.

Mr. SHAMANSKY. To some? Not an equal extent?

Mr. DRIGGS. It varies by regulation.

Mr. SHAMANSKY. Whatever it is, they are on an equal footing with an American company.

Mr. DRIGGS. Yes.

Mr. SHAMANSKY. Therefore, if I, as a legislator, have a desire to promote an American competitor—you can identify this sort of—is that not a legitimate concern of mine?

Excuse me; I am going to give the chair back to Chairman Glickman.

Mr. GLICKMAN. Go ahead.

Mr. SHAMANSKY. OK.

Mr. DRIGGS. I am sorry; have you finished your question?

Mr. SHAMANSKY. I hope I finished it; I want to let you go ahead and finish your response.

Mr. DRIGGS. We think it is certainly appropriate to encourage American development and the research in America.

Mr. SHAMANSKY. Then you would agree that the elimination of these regulations would apply equally to foreign competitors as well as American competitors?

Mr. DRIGGS. Yes, essentially.

Mr. SHAMANSKY. And the same would be so with, say, the changes in the Clean Air Act?

Mr. DRIGGS. Essentially, yes.

Mr. GLICKMAN. Would the gentleman yield?

Mr. SHAMANSKY. Surely.

Mr. GLICKMAN. One of the things which was contained in your statement, Mr. Driggs, concerns the Clean Air Act—your efforts to try to return emission standards back to where they were in 1980. I was in Japan last year, and Japan's emission standards for Japan, I believe they told me—you will have to correct me if I am wrong—are more stringent than current U.S. emission standards. If so, I am curious—they are still able to sell plenty of cars both at home and abroad. They have not found the clean air situation to be much of an impediment to their sale of cars. Why do we feel it is such an impediment to our sale of cars?

Mr. DRIGGS. To go to the higher standards currently mandated by the Clean Air Act would require significant investment in new technology by the American automobile companies. This would be a significant diversion of cash that should be going into other product development from companies that have had a negative cash flow of \$22 billion over the last 3 years and probably will have a negative cash flow this year, to achieve a very modest level of improvement in the environment, a level of improvement that will significantly be achieved anyway once the older cars are retired.

The average age of the car now on the highway is approaching seven years, many of them with few, if any, environmental controls at all. As they are retired, and as the technology is spread throughout the fleet, the performance of the average car on the road will increase.

So, it is a question of best use of resources, if you will.

Mr. GLICKMAN. OK. Again, I make my point that there must be some other reason. I would hate to see us pinpoint the Clean Air Act and its compliance as the reason that our companies cannot sell cars, because the Japanese have shown that you can comply with even more stringent clean air requirements and still not have any problem selling cars.

Mr. DRIGGS. I do not think we can pinpoint any one item as the reason why the Japanese can sell cars and we cannot. There are a myriad of reasons.

Mr. GLICKMAN. Let me ask one final question. This administration, as previous administrations, seems to have accepted the need for Federal support of civil aeronautics programs, both in terms of long-term research and development through NASA.

Why not have an analagous method for support of the automobile? We work cooperatively—our Government—with the Boeings, the Lockheeds, the Cessnas, and the McDonnell Douglasses over the years, in building a system where there is a positive, cooperative role between Government and industry. It has not had that historical competitive contentious role that we have had with the automobile industry. You can have that cooperative role. You do not have to just totally remove yourself from the picture, as I see the trend now in this Government—let us just let them do their own thing, and they will be able to compete.

The problem is, Toyota has got a friend in the Japanese Government; Nissan has a friend in the Japanese Government; Volkswagen has a friend in the German Government.

I am just saying, why cannot we be a friend to our industry and, in doing so, do more than just get the regulatory burdens off their backs. The Japanese Government has still insisted on the regulatory burdens, but they have done some positive things, too.

I see an analogy in the aeronautics role that I do not see in the automobile role, and you in the Commerce Department, I think, ought to be interested in that because of our need to continue our exports overseas.

Mr. DRIGGS. I will certainly look at the example in the aeronautical area. I confess that I am not personally that familiar with it, so I cannot draw the example now.

We have a long history, as you well know, in this country of, in effect, separating business and state. We do have a different attitude toward business than Japan, and, certainly, we have had a different attitude toward the automobile industry. For so many years it has been so rich and so powerful; it has been viewed more as an adversary and more as something to be controlled and regulated than something to be fostered.

It really struck home, I think, to the country in the last few years that the American industry is subject to competition, just like the automobile industry is subject to world competition like any other industry.

The approach the administration is outlining is one that tries to be sensitive to that and recognize the fact by saying that the American automobile industry is in a period of very significant transition. There is a structural change occurring that will probably result in an industry that looks significantly different in the future than it has in the past.

We think that one cannot and perhaps should not try to reverse a tradition that has built up over decades in dealing with it, but should try to look at those things which Government can do and where we can influence what is happening to try to be supportive of that, and that in effect is the underlying principle to the administration's program that I outlined a few minutes ago.

Mr. GLICKMAN. I just would close by recalling the words of Senator Everett Dirksen who once said, "I am a man of principle, and my first principle is flexibility." I think that perhaps that is embodied in Mr. Shamansky's bill.

Mr. SHAMANSKY. Mr. Driggs, I would like to comment that your setting up a principle that Government is one thing and industry is another, I think, misses in fact what this country is about. We are so inextricably involved with each other; the list of things that you said this administration is pushing, like changing regulations and providing all kinds of tax incentives, is a deliberate Government policy focused at a particular activity in this country. To say that shows noninvolvement is a very peculiar way of looking at things, it seems to me.

Mr. DRIGGS. Sir, it is Government which imposes the regulation and Government which imposes the taxes.

Mr. SHAMANSKY. But any tax system, by what it does and does not do, has an effect. They are both policy choices, is what I am trying to suggest to you.

Mr. DRIGGS. Yes, absolutely.

Mr. SHAMANSKY. So, to maintain that one is appreciably different from the other—you may have different effects, but the principle, it seems to me, is the same. It is an involvement whether you want it or not, and we are concerned—certainly I am concerned—with the fact that, whatever your administration has been predicting since it came into office, it is still waiting to happen. In the meantime, it has gone down the tube. But I do not want to jar anybody.

Just before finishing, Mr. Finkelstein, I am still fascinated by your testimony on page 2, in which you say, "While an incentive approach is preferable to the imposition of mandatory performance standards, the bill as drafted would place a contestant in an untenable-risk position both financially and technically. We believe that major flaws in the bill would discourage serious participation in the contest, dilute the incentive effect, and thus fail to stimulate the technological developments desired by the bill's sponsors."

Let us say that is true, in which case no one would enter—right?

Mr. FINKELSTEIN. Correct.

Mr. SHAMANSKY. Good, and it would not cost the Government a penny.

Mr. FINKELSTEIN. The problem that you could run into—we do not believe, in the Department of Transportation, that it is impossible to put these kinds of prototypes together. We believe that in fact programs with reasonable financial backing could be put together where these prototypes could be delivered and developed. It would be a challenging program; it would be a very exciting program.

Mr. SHAMANSKY. And you do not think that would be worth, say, half the price of one military airplane to this country?

Mr. FINKELSTEIN. I do not know what one would get for the development of prototype vehicles that can meet these requirements.

Mr. SHAMANSKY. You do not understand? You cannot comprehend what value that might be to the country? Is that what you are saying?

Mr. FINKELSTEIN. I cannot understand how producing those prototypes will be of enormous value—of real value—to the country.

Mr. SHAMANSKY. I believe you, that you cannot understand that. I hope you understand what I respectfully say to you: I do have a different concept. I think it would be very valuable, and that would probably explain the difference of opinion.

Mr. FINKELSTEIN. We have developed prototypes in other areas in automotive research. We have developed them. We have had, frankly, great successes building vehicles that could meet specific technical requirements. That is far different from building a vehicle that, having met those technical requirements, all of a sudden turns into a marketable commodity.

Mr. SHAMANSKY. Then you agree that the bill, though, does address the test-marketing aspect?

Mr. FINKELSTEIN. Oh, it does do that.

Mr. SHAMANSKY. Good.

Thank you very much, gentlemen.

Mr. GLICKMAN. Our last witness today is Dr. Dwight Baumann of the Transportation Research Institute, Carnegie-Mellon University, Pittsburgh, Pa.

It is a pleasure to have you here, Dr. Baumann. We have your statement. I might ask, if possible, if there is a way for you to summarize it for the record. It will appear in its entirety. We would like, if possible, to close this hearing in about 20 or 25 minutes.

Dr. BAUMANN. I did not intend to read all of that.

Mr. GLICKMAN. OK. Thank you. You may proceed. Without objection, your statement will be included in the record.

STATEMENT OF DR. DWIGHT BAUMANN, TRANSPORTATION RESEARCH INSTITUTE, CARNEGIE-MELLON UNIVERSITY, PITTSBURGH, PA.

Dr. BAUMANN. Thank you, Mr. Chairman.

I have been told that a management psychologist tried to find the difference between various countries' automotive executives, and he said to Mr. Ican Hopa, president of a well-known firm in the United States, "What would you do if someone told you that you could spend \$140 million and get a car that runs 100 miles per gallon?" And the executive said, "If it didn't work, would I be blamed for that, too, and would you lend me the money?"

The psychologist went to see another gentleman, Dr. Fillach, and he said, "Would you build a car with 100 miles per gallon if you knew it cost \$140 million, but if you won you would make billions?" And he said, "Ach, Himmel, we did that last month already. Don't you read the newspapers?"

Then he went to see Dr. Cando in another country, and he said, "Dr. Cando, if you could make an automobile that did 100 miles per gallon for \$140 million, and if you won you would make bil-

lions, would you do it?" And he said, "Of course." And he said, "Why?" He said, "Ah, so; it is the American way."

The problem that we are facing today—and this meeting has been very interesting to me because we have been talking about one of the perhaps second or third oldest topics in America besides baseball, football, and a few other things—second-guessing the American automobile has been a pastime.

I suggest in my testimony that there are a number of other possible technologies that are equally attractive to the one of reducing the energy costs. I think the energy cost is a symptom of a disease. It is an issue that people think might be worthy of facing the facts about the American automobile industry moving offshore.

It is moving offshore, but so have other industries. It is just joining the camera industry, the electronics industry, and some of the petrochemicals industry, and the steel industry.

The question is, What can we do about it?

First I would like to address some of the alternative technologies, because I would like to put these in a spectrum. I think the problem of energy is just one of several problems. I believe that history shows us quite well that if we found a car that would do 100 miles per gallon we would probably just drive farther, and we would probably use the same amount of energy.

So that, per se, is not necessarily a useful goal by itself. The question we are trying to address here is how to revitalize what is our largest or one of our largest industries.

If we look at some of the other alternatives that could be addressed—I have suggested in my paper a number of them—various drive-line components, various engine styles, flywheel systems, and so forth.

I operate a Center for Entrepreneurial Development. It is a non-profit organization that helps inventors, very similar to Battelle's organization. We are dealing primarily with startup of new companies. I receive 50 to 100 automotive ideas a year that are good ones, but I usually have to tell the people, "You can't do that here. See if you can put it on a lawn tractor; maybe John Deere will like it; but the automotive industry is too tough a nut to crack."

I think Dr. Fawcett's comments came from the same kind of understanding of what happens when the American inventor tries to face this Goliath.

I have tried the same thing, and I want to show you a little bit about it just to bring you into the picture of what I have faced and why; I have tried to be analytical about it. First, let me tell you about the project.

Some years ago we were concerned also about the energy issue, and I had some of my students work on electrification of the automobile. Why? One of the reasons was that, if we do not know what kind of source of fuel we will have in the future, we can be sure that distributing it electrically would be useful. It might be hydro-power; it might be solar power; it might be some kind of nuclear power; it might be fossil fuels; it might be vegetable oil. But we could distribute it through electricity. People saw that very clearly and decided that a battery was a good way to store this electricity while one was mobile.

We looked at the possibility of picking up power from the way-side while traveling in congested corridors. When we did this, we discovered that the difficulty of picking up power, of keeping the guideway in contact with the vehicle well enough for power to be picked up, was much greater than the difficulty of steering that vehicle. We found that, contrary to the way that most railway systems are designed, you do not want to build a vehicle and have its steering device work and then add a power pickup system. You add a power pickup system, and the steering comes for free.

As we started looking at that kind of vehicle, we found that it had some other advantages. Primarily, it allowed one to automate the vehicle, and in doing so one could achieve urban transportation densities equivalent to eight lanes of freeway in only two lanes of automated roadway. Furthermore, when one did this, the automated vehicles would look like mass transit vehicles, because someone who did not have a car or could not drive could come to the vehicle, climb in, and use it, and thus we would not have to spend money for the highway system and money for the urban transportation system.

I can show you just one slide, if it is there. I will not go into it very much further. In 1967 we put together a Ford Mustang which had all of its driveline intact with the exception of a small electric motor in the trunk and a power pickup on the side of the vehicle.

Is it going to work? Well, I will go on, and if it does work, you can look at it.

This vehicle, as we used it, was gasoline powered during the low-density trips.

It turns out that 90 percent of trip-making in the United States is urban and is repetitive. It happens day after day after day.

The advantage of moving in the direction of automated is greater, I believe, than the energy advantage, because it does not put us into a hole when we run out of a specific kind of energy; and it combines mass transit and auto transit; and, most importantly, it enfranchises the 50 percent of the Americans who now cannot drive. Fifty percent of us are dependent on others to haul us around.

All the projects that we have tried to do in UMTA have not succeeded to compete with the American automobile because of its ubiquity.

This is what the system looks like [indicating slide]. There is an arm that reaches up inside of the rail. In the next slide you will see what the rail looks like [indicating slide].

The idea is that a corridor of a city could be electrified—a high-density corridor, one where one might like to have an expressway, but could not find the space. Then the people living in that direction could buy such cars, and then the mass transit could ride it.

Now, why bring this out? This is another kind of system that cannot be built under the present rules of the game.

UMTA has failed massively in trying to build mass transit systems under the NASA-type procurement rules, because the ingenuity was limited by the capability of the request-for-proposal writer.

We perhaps have some of that in this proposed legislation, but I think there are some ways around it, and I basically support the

concept of having Government find a way to insure or provide some of the risk capital to revitalize dead industries.

The question is, How can some of this be obtained? My guess is that, if the \$140 million were spent, the next best thing for the people who spent it to do would be to sell the company to Honda or Volkswagen. In other words, what I am suggesting is that 10,000 vehicles is not enough. On the other hand, \$140 million seems like a lot of money.

So the question is, What should one give as the reward? The simplest reward to give is the one that is also the most important, and that is a share of the American market.

So I propose—the requirements, as they are stated in H.R. 5880, are relatively OK. One could stretch to reach them. They are not a piece of cake. It requires some effort and some intelligence to be supplied. But the concept of protecting the investors in that effort should be changed somewhat.

At present I would see \$140 million as being essentially second-round financing for an organization that had put \$10 to \$20 million of their own money into the prototype development.

It is not enough financing to compete with major auto companies, but it would be second-round financing, and it might attract third-round financing from the public sector, and thus it has a reasonable logic to it.

The problem we have however, gentlemen, is that this same thing repeats itself. It is not only true in high performance automobiles in terms of energy or low-energy automobiles; it is true in television sets, and it is true in all kinds of appliances; it is true in computers. It is true in many areas that the cost of making the first one is so much bigger than the cost of making the second one, that there needs to be a way to protect that investment.

Long ago we had a good way, and the people at Battelle are certainly aware of it; it is called the patent. The things that needed to be invented were simple enough. They were simple enough to be written on a single piece of paper. The low-energy automobile—the high-mileage car—is not that simple, and most of the ideas exist, and so there is not the piece of paper on which one can write down the contract that the developer would like to make with society in order to fulfill a commitment to provide a benefit to society and give something in return.

The concept of patents that we have been using for about 550 years is one where society gains in technology and knowledge and the developer gains in having a limited monopoly.

The word "monopoly" has been a bad word, but if you go back, the question of disalienation of the means of production is a very old one. King Ahab got into trouble trying to buy the vineyard from nextdoor when the laws in Leviticus did not allow land to be sold out of the family.

The concept of disalienation of rights continued through the period of time when letters patents were granted by the Crown of England, and for many years letters patents were not available to foreigners. At other times when foreign investment was required, they were made available.

When the Continental Congress convened and formed our own patent codes, until about 1836 foreigners were not allowed to have

patents. Later, there were some movements to bring foreigners who would invest and build a sugar plant in Philadelphia and give them such a patent.

There is an interesting precedence in your own State of Ohio, sir. Congress, in 1875, decreed that "30,000 acres of land in the new Purchase to the West of Ohio be given to James Rumsey provided he shall before the first day of May next produce good and sufficient Evidence that by means of certain Mechanism of his invention Wrought or aided by three men only, a Boat carrying ten tons has been moved for six days in succession against the stream of the R. Ohio at the rate of 50 miles per day."

It sounds like it is a paraphrase of your bill.

Mr. SHAMANSKY. May I ask if you like the idea?

Dr. BAUMANN. I think it was an excellent idea, because it did provide a way to get up the river Ohio.

Mr. SHAMANSKY. OK. Do you think this would be a good way to get to a fuel-efficient car?

Dr. BAUMANN. I think it would be an excellent way to get to a fuel-efficient car, but I think the rights that one would have to give would be essentially what I would call a systems patent. You patent the global concept of a car that is better than any present car, and the rules about how much better might even be negotiated with the people who were working on it.

But here is the peril: If they miss and someone comes along with a better car, they lose. So, like patents, it would be supersedable by better technology but could be kept for about a 5-year period; I think that would be reasonable—5 years of production rights would be granted in the same format as the letters patent; it would be supersedable; it would be marketable.

I am not so concerned, sir, that the ownership needs to be domestic. What needs to be domestic is the jobs. We presently have such fluid capital that the rent on capital moves across national boundaries very easily. That is not our problem. We do not need to protect sources of investment for American investors. We have plenty of them, and we have plenty of foreign investors.

The issue is jobs, and therefore the patents should be given only to people who will manufacture in this country—very similar to your bill—and this, I propose, would be a mechanism that would be understandable. I think people understand the concept of patent monopoly and would be willing to address it.

Thank you very much.

[The prepared statement of Dr. Baumann follows:]

WRITTEN TESTIMONY

Before the House Subcommittee on Science Research and Technology

HEARING ON**H.R. 5880--AUTOMOBILE RESEARCH COMPETITION ACT**

Tuesday, June 15, 1982

Rayburn House Office Building--Room 2325

Testimony before the Sub-Committee on Transportation,
Aviation and Materials

By Professor Dwight M. Baumann, Director of the Center for Entrepreneurial Development, Co-Director of the Transportation Research Institute, and Professor of Engineering Design at Carnegie-Mellon University in Pittsburgh Pa.

1 Introduction

The fact that the American Automobile Industry is in deep trouble requires no elaboration. In fact it is perhaps joining the Steel Industry, the Consumer Electronics Industry, the Camera Industry, the Petrochemical Industries, particularly the Commodity Petrochemicals, and several lesser industries in becoming part of a world economy.

We should now perhaps recall what Adam Smith, the economist, really wrote on the "The Wealth of Nations". He discussed the capitalist trading in a free, (unfettered) market. We should pause to notice that no matter what the form of government or the degree of internal subsidy or encouragement of various governments of the World, the trade between Nations follows the rules of supply and demand and a free, capitalistic market. For a long time there were gold standards and dollar standards that had a force of the corporate, world opinion of nations protecting a form of economic stability that may have favored specific innovation, labor productivity increases, and specific natural resources from time to time. But now we live in a world that is trading off those parameters in terms of a barter of balance of payments and valuation and reevaluation of the individual currencies of individual nations depending on the relative attractiveness of their production of national product to the world marketplace. Our basic national disadvantage comes from the fact that the world now has a tremendous mobility of capital and thus we no longer have quite the competitive edge in capital formation.

Several important conclusions thus follow from this analysis. The competition between nations is in great part the competition between a combination of the private and the public sectors of the U.S. and the other industries and nations of the world. Nations which have a different

internal relationship between their governments and their industries may have a differing degree of advantage or disadvantage in regards to specific products. In a dual economic system such as ours, the roles of government and industry are in flux and thus the relative roles of the principal parties needs to be redressed continuously.

The common dimension to innovation, in the sense of the total development of a new or renewed technological enterprise, is creativity of several dimensions -- product, finance, marketing and attractiveness to qualified and loyal colleagues. A common description for the persons that are central to innovation in the total sense is entrepreneur. This word, from the French, meaning one who "undertakes" -- risks his position, reputation, power and/or finances, is not unique to a capitalistic society or to a mixed capitalistic plus socialistic society such as we find in the U. S. Let me digress briefly to point out that if U. S. enterprises were organized to return all the rewards of risk to the stockholders that would be capitalism. If it all went to the government, it could be called socialism. Since we couldn't decide, we split it down the middle via taxes and gave half the reward for risk to each. Of course Congress is making changes in tax policy which may have some long term effect if the other aspects of the "joint ownership" theory of American enterprise doesn't or hasn't rebalanced the equation.

Originally, in the U. S., the government was a silent partner, but because some of the business school types began to focus on short-term gain in an oversimplified quarterly financial analysis, our society responded and is now responding via regulations imposed through the democratic process to force what is deemed to be the equivalent of a long-term or future concern on our corporate structures. I observe but cannot substantiate, that most of the ills which the political system is trying to correct are caused by large and mature industries, yet the remedies are presently being uniformly applied to both old and new enterprises. I also observe that when the founders of an enterprise remain in control, they tend to concern themselves more with the long-term effects and opportunities and perhaps are more sensitive to the total impact of their product or service. Legislated change that requires dramatic, capital and resource intensive response tends to favor large organizations. I suspect that sensitivity to political and technological changes that require quick response and creative interaction favor the smaller, more personal organizations. The Japanese firms behave more like our smaller firms. The proposed legislation seems to favor firms that are responsive to change and thus I am in favor of the concept, but have suggestions on the implementation.

If product innovation is to take place it must have all three components, technological innovation, capital formation and attractiveness to those minds and resourced that are capable of "making things happen". Our mature industries have tended to focus on only the financial aspects of the equation. I believe that H.R. 5880 addresses each of these areas in part. I shall develop the theme that, the topic of the bill, an energy efficient automobile, is but a part, albeit a large

one, of the whole. Furthermore we need to learn from history that some of the things that are happening have happened before and that they have had corrective action by the parties to the problem before.

The bill, H.R. 5880, as I see it has three aspects that require an analysis, and is based upon several premises. The aspects are:

- The specific technology chosen to be enhanced--an energy efficient automobile. This needs to be put into the context of alternative choices that would enhance the automotive market.
- The concept of the reward for risk and technological breakthrough. This reward structure needs to be compared to alternative reward systems.
- The consideration that the industry to be enhanced, should specifically be an American owned and operated industry. In part this also deals with the potential response of foreign industries and the retaliation of foreign governments

The premises of H.B. 5880 that require analysis can be separated into three parts. One--The physical achievability of the technological goals. Two--That the results could be expected to obtain the desired long term economic effects. Three--That the plan and its short and long term effects are consonant with the present and future goals of our society.

As I see the problem, I shall try to address these first two premises and do a minimum of elaboration on the third. The third premise is predominantly related to a political assessment and is in the domain of expertise of the members of Congress. I have learned not to try to out guess the voters or their elected representatives. I shall however, venture to add to the mysticism of the American politic by making some suggestions, from history, of a more general solution to the problems being specifically addressed by H.B. 5880.

I shall address the questions, and hopefully some of the expected answers to the results that would be obtained from the application of H.R. 5880 in several ways. Then I shall suggest some modifications that I believe would be more effective and have more significant precedence and thus predictability of results.

2 Background

First let me introduce myself and establish my credentials. I am Dwight M. Baumann, Professor of Engineering Design at Carnegie-Mellon University, Co-Director of the Transportation Research Institute and also am the President/Executive Director of the Center for Entrepreneurial Development, Inc., a non-profit institution affiliated with Carnegie-Mellon University and organized for the expressed purpose of studying the development of new enterprises in a clinical

environment while assisting in the incubation of new enterprises. The clinic functions as a teaching hospital. The patients are entrepreneur/inventors who have convinced us of their abilities and their drive in organizing a new enterprise and, furthermore, have needs that are within the capability of the Center, its staff and resources. As a part of my activities of this Center, I am the President and CEO of Peoples Cab Company, an experimental Taxicab Company with a fleet of 35 vehicles, the second largest in the city of Pittsburgh. More about the Center later.

I was born and raised in the State of North Dakota. I attended North Dakota Agricultural College where I received my Bachelor of Science degree in Engineering in 1955. I attended M.I.T. on full scholarship for my Doctor of Science degree and served on the faculty of M.I.T. for 15 years in the Department of Mechanical Engineering. I moved to Carnegie-Mellon University in 1970 to head up the interdisciplinary graduate program in Engineering Design and to initiate the Center for Entrepreneurial Development. I have former design students in all phases of the spectrum of American industry, from president and chief engineer, and down through all levels of design, some have alas, not yet made it past draftsman. Several are owners of their own firms, some in the transportation industries, several in the computer industry, including some in the hundred million dollar per year category.

I maintain good contacts with the transportation industry through research efforts in our Transportation Research Institute in urban, rail, and paratransit systems. I am active in local, state, and national taxicab organizations, have designed and built various kinds of automotive and paratransit systems hardware, some of which I will show later. I am and have been active in vehicle maintenance at all levels, even personally undertaking major rebuilding of diesel and other engines, rebuilding, modifications, restorations etc.

I was attracted to Pittsburgh because the City did not have an image of being a center of new enterprise development. The heavy industries in the area did not have the image of spinning out new technologies and new companies and, in general, it looked like a good place to initiate some experiments in entrepreneurial development. We do not limit the field of entrepreneurship to small or new companies, but have studied the topic in large firms as well. We interact mostly with start-up firms, because that's more fun. Thus throughout, I have thought a lot about industrial revitalization. I have been on the Governor's Economic Advisory Committee in Pennsylvania chaired by Larry Klein, and have been active in the Development functions at the city, state, national, and international levels. I was privileged to serve on a special task force called by my former M.I.T. colleague, Dr. Robert Wood, when he became the Undersecretary of HUD, at its founding. During that task force's deliberations I participated in the drafting of the legislation establishing the Urban Mass Transportation Administration. Thus I have been able to watch with interest the differences between idealistic intent, legislative correction and adjustment, and I might say disappointingly, the actual accomplishments of the UMTA in urban transportation.

In order to put my testimony into further context, let me elaborate slightly on my own participation in entrepreneurial activities and my experiences with the transportation, professional and industrial community.

For about 10 years of my academic career at M.I.T., I was curious about the fact that high technology industries appeared to cluster, sometimes around a major university. This caused me to try to find out why and to build a hypothesis of what would be needed to start a new cluster, say in Pittsburgh. What are the necessary ingredients: a university, a venture capital community, tax incentives, an industrial park, role models, community activities and image, governmental interest, prizes, stronger patent laws, etc.?

At M.I.T., I developed an advanced course in engineering design and entrepreneurship that has itself become a model that is used at several dozen, major business and engineering schools. In order to prove that I could practice as well as teach and in order to learn more about the process, in 1963 I founded Icon Corp. with two students. I was on the M.I.T. faculty at the time and became the President of the firm. We each put in \$300 and rented a \$35/mo. room in the loft of an Odd Fellows Hall. The company built electronic drive and control systems for stepper-motors used for various factory automation, robot and other numerical control functions. Even then we were a licensee and distributor of Fujitsu motors. I was active in negotiating the relationship with the Japanese firm. The company was sold some 6 years later for approximately \$1 1/2 million to the United Shoe Machinery, Inc.

I later participated as an outside director of a new start-up company, Graphic Sciences, Inc., while one of my graduate students became a chief engineer and together with a small team of designers, we developed an advanced facsimile sending and receiving system for office use. That company raised over \$30 million in public stock offerings, much of it before the product was even developed. Graphic Sciences has since been sold to Burroughs Corp. and continues as their "DEX" product line.

I have spent some time investigating entrepreneurial activities in Latin America and Europe and have been a U.S. Delegate to an East-West Conference on National Innovation Policy in Vienna, Austria. I organized a Conference for Deans of Business Schools and Deans of Engineering Schools to discuss and develop curriculum in entrepreneurship and management of technology that was part of the recommendation of the Carter White House Domestic Policy Review on Innovation.

As I have developed my perceptions of the world of entrepreneurship, both as a practitioner and as a teacher, I have tried to ask the basic questions that have been part of my training as an advanced degree holder in an areas of systems analysis and engineering design. That questions of

course is, "How does the system presently function and why?" concomitant with the question, "Can we design a system to perform the function better?"

The Center for Entrepreneurial Development

The Center has assisted in the start up of 16 companies in the Pittsburgh area since 1972. Besides this, there are now 8 second generation companies founded by members of the entrepreneurial team that were involved in a first start-up, who later left to begin their own enterprises. The largest and first company, Compu-guard Corporation, has offices in four cities, 175 employees, and was sold to Brown Boveri of Switzerland for in excess of \$6 million, a little over a year ago.

Through this latter experience, in our experiments in developing new industries in Pittsburgh, I have had to answer the question of, "How do you feel about the fact that your most successful experiment ends up being owned by a foreign firm?" My answer has been, "I'm sorry, however, the jobs are still in Pittsburgh. Besides, should it be my fault that the people that have the most confidence in the financial future of a new, high-technology American born firm, don't happen to live here?"

Since the Center is a non-profit organization, I, as the director, am restricted by our bylaws from personally profiting from any of the Center-related ventures. My interest in development of the center concept is thus primarily academic, and I feel rewarded by the fact that there are now over a dozen similar centers being developed at other U.S. universities. The Canadian government has authorized five; two are already established. Furthermore, there is significant interest and some similar activity in progress in Sweden, West Germany, Ireland, Finland, Australia, and New Zealand.

The Center's experiments and the non-profit revolving fund and functions were in part aided by a \$1 million grant from the Intergovernmental Sciences and Public Technology division of the National Science Foundation, given in 1973 for 5 years. The purpose of their grant was to support an experiment to see if a university based, non-profit revolving fund could become a stable generator of new, high technology enterprises. About one-half of the NSF grant went into university based educational activities and overhead. The other half of the grant went into the supply of services in kind which when repaid, were used to develop the revolving fund. The revolving fund has been used to finance assistance and out-of-pocket costs for some of the start-ups. In some cases, the Center provided space, telephones, legal and accounting assistance in the form of paying for the direct costs of services provided by lawyers and accountants in private practice. In each case where there were services rendered or where costs of any kind accrued, these are considered as loans to the fledgling companies. The amounts have varied from \$20 to

\$60 thousand. In return, on the order of 5% to 18% of the founders stock was given to the Center to reimburse the revolving fund in compensation for those start-ups that might fail. Thus far, we have had two failures.

Each of the Center of Entrepreneurial Development's involvements begins some time, usually a year, before actual incorporation of a new venture. The center may place a member on the board of directors. We continue active participation until venture capital can be found. During the periods when venture capital was scarce, we formed some companies that did not need outside investment. Two of these companies may grow directly to the stage where public stock offerings are the first outside capital. In the cases where venture capital becomes available at some stage, we assist in finding the capital and then transfer our board position and our care an concern to the venture capital organization.

We have not and do not intend to compete with venture capital firms, banks, SBIC's, MESBIC's or regional development agencies. We try to determine that all these other avenues of approach to assistance are not available to each entrepreneurial group we become involved with before we make financial commitments. We deal with prenatal and postnatal care of embryonic companies. In the cases where the venture capital firms come in to provide pediatric care, we try to have our loans paid back as soon as possible. If they are not, we have been continuing for a short time in a relationship that is much like we would be involved in if we were the local member of a venture capital syndicate. The major difference, of course, being that we were involved some three to five years earlier. Since we operate in a city, Pittsburgh, that does not have much activity in venture capital, we believe this venture function to be transitional. There is beginning to be some talk about development of more local venture capital firms. Perhaps a new maternity ward can eventually attract resident pediatricians.

Within this context, the proposed H.R. 5880 is a mechanism that intends to enhance American entrepreneurship in the energy efficient automobile industry. While the bill is intended for either or both present automobile manufacturers or newcomers to Automobile production field. The design tasks are difficult enough as spelled out in the bill, that only some of the most sophisticated research and development organizations would be expected to have a chance to be effective winners, but then in this field of innovation, and particularly innovation in the automotive industry, there are a great many experts. It is well known that many of the so-called foreign automobiles and trucks actually have major components and some entire vehicles that were designed in and around Detroit.

I see the bill as being equivalent to second round venture capital. I agree that in the present condition of the economy and the automotive industries image on Wall Street, that the probability of other forms of secondary financing does not exist.

3 Technological Issues--Feasibility of Technical Goals

The specification for the proposed low energy vehicle is based upon several assumptions. The underlying assumption is that a technological breakthrough is possible, in other words, it does not violate any laws of physics and is within the realm of economic possibility. The most serious test for an engineered system that must eventually be sold in the open market is that it must, at some projected time, be cost effective in terms of the value of the improvement of reduced energy consumption at an equipment cost that would be low enough to justify the annual savings. Here it is important to agree with the letter from Maxine Savitz, Deputy Assistant Secretary for Conservation of DOE, to Ted Stevens that the difference between a presently expected 75 mpg car and a 100 mpg car is small. She estimates \$100/year for \$3 gas and 10,000 miles/year. That small difference means that the marketeers who plan Detroit's present investment strategy would not decide to spend much money in this direction. They can save more money by cutting the cost out of labor. A new firm or a firm coming into the auto industry from some related field, such as the automotive aftermarket component field may make a different decision.

Furthermore the competition, if it is to be held, must be realistic in the sense that competent parties will take it seriously, and respond by joining into the competition. And finally the reward must be justly related to the risk. The degree to which the reward is appropriate is dependent on the scale of past involvement of the participants. An organization may have to spend on the order of \$10 million just to build the required prototypes, even if they presently have or know how to get the technology. To them the second round financing of \$140 million would be an attractive stage. On the other hand, with a subsidy of \$140 million for the first 10,000 cars to the winner of the competition, and awards of \$20 million to each of the four runners-ups, the scale of the H.B. 5880 is ridiculously small compared to the sums currently being spent in Detroit by the private sector. In 1981, for instance, General Motors produced 5.5 million cars and spent close to \$10 billion for plant, equipment, and tools as noted in the annual report for that year. Consequently they most likely wouldn't accept the money because they wouldn't think they needed another "boss" in terms of the Secretary of Transportation looking over their shoulder. Some of the smaller automotive firms may make a different decision.

3.1 Engineering and Physics Considerations

The primary considerations of the laws of physics involve the energy requirements due to the resistance of the air and rolling friction to forward motion plus the requirements of force and thus energy (force times distance) to accelerate and climb hills. In order to improve as system by as much as a factor of two (H.B. 5880 suggests about twice the present practice), all the areas of energy usage must be improved.

In order to save in air drag, the frontal area of the vehicle and the shape of the vehicle must be carefully designed. The Volkswagen "bug" was actually quite good in this respect. To conserve energy due to rolling friction, the tires and gear train need considerable care and several incremental improvements. The requirements of meeting the acceleration and hill climbing specifications with the lowest installed horsepower indicate the need for an energy storage device such as a flywheel, or battery, to store the energy from coming down hill or deceleration, so that it can be used to go back up the next hill or accelerate the next time. Combined with all this must be a significant improvement in engine efficiency. Also all the redesigned components must be manufacturable at low cost with high reliability. The latter indicates highly experienced designers, adequate financing, considerable testing. Need I add that it would also indicate significant effort and cost in compliance with all the safety and consumer protection regulation and conformance requirements. (Consider the cost of one recall as compared to the prize.)

In preparing for this presentation I conferred with a number of my colleagues in Mechanical Engineering at Carnegie Mellon University. Professors Norman Chigier, Holger Sommer, and Wm. Sirignano, who are active in the area of combustion research, agreed that they would also not expect more than a 10 percent increase in energy efficiency in internal combustion engines during the next 3 to 5 years. Thus the majority of the required improvements must come from a combination of all of the other potential savings. Lieutenant Colonel John Wiss, Retired Director, U.S. Army Tank-Automotive Labs, Detroit Arsenal, long active in the automotive engineering field, and himself a developer of new engine modifications, and now affiliated with us at Carnegie Mellon University as a Sr. Research Engineer, prepared a more detailed analysis of the specifications of H.R. 5880 and concurred with me in most of my following recommendations. I will make a copy of Mr. Wiss's analysis available to the staff, if they so desire.

The proposed specification need not require an 850 lbs minimum load for the acceptance test, a 250 lbs load comprising a 150 lbs driver and 100 lbs of instrumentation would be a more standard test. The maximum vehicle load could be 850 lbs, the U.S. average automobile occupancy is only on the order of 1.2 to 1.5 passengers. The hill climbing requirements need not be 7% at 55 mpg, but could be as low as the 5% slope at 40 mph required of trucks. Since the truck performance is not often achieved, the autos will still stay in the traffic patterns of truck traffic. The most strenuous requirement of the H.B. 5880 is that the vehicle have a passing acceleration at from 50 to 70 mph. That condition would specify a peak horsepower requirement of approximately 50 hp, even with all the accessories, alternator, air-conditioner, engine cooling etc. turned off. The 70 mph top speed would indicate a horsepower requirement of 40 hp, continuous, without accessories. That would also indicate the possibility that the specification of the top speed be made somewhat less, say 60 to 65.

In order to conform the bill with a specification that the layman may not understand, but has

become accustomed to seeing, it is suggested that the MPG specification be referred to the "City MPG" of the EPA that is found on the stickers on the windows of all new cars.

Even with the relaxations shown above, the requirements would still require an improvement in the state of the art over Volkswagen's announced intentions to offer a 75 mpg vehicle within 5 years.¹

3.2 Other Technologies

There are equivalent technologies that could be implemented with an incentive program similar to H.R. 5880. Because in the long run, our society cannot be sure of the forms of energy that will survive present rates of consumption, it would be prudent to force the evolution of the automotive transportation system toward electricity. Thus the system could have the electricity generated by whatever fuel is least expensive at the time, for example solar, hydro, nuclear (fusion), coal, wood, vegetable oil, etc. Then the distribution could be made to the individual vehicles either by power pick-up systems as will be described latter or by rechargeable batteries and fixed charging stations.

There are numerous component technologies that could be of possible benefit to the automotive industry in the long run but there seems to be no path to get from here to there. The Wankle engine, a huge project and now considered a failure, is both an example of and an impediment to further modifications of the same magnitude. When the automotive industry operates on scale of multiple millions of vehicles for a production run there is little room for experimentation. In contrast the Japanese have seven or eight smaller automotive companies that innovate and compete intensely for their own domestic market. Only those firms that are most successful, domestically can obtain the capital needed to attack the export markets. Absent this competition of technology on the input side, our American milieudo does not have the same characteristics of encouraging incremental change. I shall latter discuss mechanisms to encourage this kind of activity as well as the present focused problem.

Other automotive subsystems could evolve into attractive components of the automobile given a modicum of potential support to overcome the tremendous resistance to change of a large bureaucracy, both private and federal.

These alternative components could well become integrated into a vehicle designed to meet the requirements of H.R. 5880, but I believe that making too many changes at once would not be a good strategy for the designers of vehicles for the proposed competition because of all the

¹ "Automotive News" June 29, 1981

requirements of reliability, the need for repair systems, aftermarket parts and a great many other impediments to sudden change. Thus, the incremental approach to modification of major subsystems would be an attractive alternative with greater fall-back potential and thus greater probability that a lasting contribution would be made. Some examples are:

- Hybrid power trains--systems that have on-board energy storage for acceleration and can use the stored power for acceleration.
- Continuously variable ratio transmissions--these may be electric motor, generator combinations in a disk package with electronic controls, for example.
- Propulsion systems that are integrated into the wheel for a combination of propulsion and braking with flexibility and maintenance or replacement ease.
- Engines with separable redundant components so that parts of the engine could fail or be disconnected when not required.
- Engines made of glass/ceramics or other very high temperature materials that would withstand very high temperatures of adiabatic combustion.
- Engines optimized around alternative fuels such as vegetable oil, powdered coal etc.
- Various kinds of automation of the driver's function--more about this in the next section.

It is hard to fathom the tremendous investment made in the automotive manufacturing system. Entering the market with a new component is virtually unheard of at this time. Simple issues like the introduction of disk brakes required Kelley-Hayes to develop the product, set up a complete manufacturing system with a capacity of a million units a year and then they invited the representatives of the big three, for example to have the Chrysler engineers see the prototype on a Ford. Chrysler was the first to make the change, but then only when the production people were completely convinced of the stability of the component supply capacity.

In my role as director of the Center for Entrepreneurial Development, I see hundreds of automotive component ideas per year--most of them are and have been in the public domain, although many of the would be inventors who come to us are not aware of it. Even if the technologies are novel and of potential benefit, out of respect for the industry as it is, I virtually always suggest that the "inventor" forget about the idea or see if it will work on some lesser system. I'm certain that the experience at Battelle and other agencies that work with inventors is the same. It is precisely this perception that has led me to the recommendation that I will make in regards to changing the patent system.

3.3 Dual Mode Automobiles

In the previous section, I have argued that the more important issue is not conservation of fossil fuels, but the modification of the automotive system so that it can utilize a variety of fuels. This could be accomplished by conversion to battery power; however at the present state of the art in battery technology they remain quite heavy and thus do not give good performance in terms of acceleration or range. There is another method of electrification, and particularly incremental electrification which I and colleagues at CMU and previously at MIT have been working on. Previous work has also been done in the area at the Ford Motor Co., American Motors, Cornell Aeronautical, and I believe Battelle Institute. I believe I was among the first to work in this area in about 1964-65. Thus far I have supervised some thirty PhD and MS theses in the area of design of electrified vehicles with on guideway electric power pick-up capability.

I named the type of vehicle system that could have both on guideway and off guideway capability, "dual-mode" and thus far that name seems to have been used in discussing this class of systems in the U.S., Japan, and Germany. In the latter two nations there have been experimental systems built. In the case of the U.S., I and my students have been the only experimenters in this field which I believe we founded. There was one other experiment of a battery powered vehicle with a guiding device supplying direction only. That system will be called the StaRRcar, and was privately financed by an intended start-up firm by a man by the name of Alden.

The Dual mode system as we have envisioned it would be dual in several dimensions. The dual nature of on guideway and off-guideway or on roadway has been discussed. We also envisioned that the on guideway portion should obtain electricity from the guideway, and thus the automobile could evolve with an electric capability via an electric motor connected into the drive chain, that could eventually further evolve into a system that had battery power when off the guideway and line electricity when on the guideway. More significantly, however, the dual mode system would be automated while on the track and manually driven when off the guideway.

In its automated phase the dual mode vehicle would have the door to door speeds of a dedicated guideway vehicle that had no stops except at the origin and destination. Considering that the present urban bus systems have equivalent speeds on the order of 4 to 5 mph, based on an inclusion of time spent waiting for the bus, and autos average from 10 to 18 mph even where special signaling etc. is in place, this feature alone would have tremendous advantage over either the present auto or over a bus or other mass transit system. The capacity of a guideway in the automated mode could exceed a six lane highway and yet consume only the space of a single lane in each direction. We envisioned that the guideways would take over abandoned rail right-of-ways that now crisscross most urban areas or would be share corridors with freeways.

powerlines and other linear systems. Where new right-of-way would need to be taken, the system would utilize a lane only some twenty feet wide and could be built overhead, underground, along alley ways and even through existing buildings because the cross section of the guideway system has a small enough dimension.

A result of building a mile of guideway for automobiles would be that if the guideway supported some captive vehicles that always stayed on the guideway, then each mile of guideway could also be considered to be a mile of mass or public transit. In this way the highway dollars and the mass transit dollars could both be spent on the identical structure with a large societal benefit.

Because of the non-stop, portal to portal nature, the transit rider would have tremendous time benefits. The use of dedicated vehicles that enclosed small passenger compartments as the automobile does now, would allow the transit riders to ride in comfort and safety. This kind of system would allow a busy mother to send her small son or daughter off for music lessons without accompaniment, or send to car out to the store without a driver. In its advanced stages the proposed dual mode system would have all the benefits of mass transit efficiencies and automobile amenities for every citizen. In essence the system enfranchises the 50% of the American public that now is not licensable to drive or does not have access to an automobile. This portion of our society, one-half, are now primarily automobile dependent, they must wait for someone to take them. The present mass transit systems do not work, and they do not pay for themselves because they do not work. As I have already stated, the equivalent speeds are only a little better than walking and the average load of the major carrier the urban bus is only 6 to 8 passengers. The busses need to run during peak and off peak times but suffer from being overloaded or almost empty. Virtually all kinds of quick fixes have been tried for mass transit but they have failed. Now when our domestic automobile is also in difficulty, it is time to move in the direction of making an order of magnitude improvement in both.

Change of this magnitude requires concerted effort. If one considers the new found mobility that a dual mode system could accomplish, since at present most suburban housewives spend more hours per day as a chauffeur than any other function, then the increased mobility is a product that Americans would pay for just as they have paid for the American automobile system. The gasoline tax has been our only pay-as you-go tax and it has paid for the system. From the viewpoint of the economy, another method of enhancing the economy, is producing something that the consumers want to pay for, so that they will continue their ambition for improvement. The proposed dual mode system would have a second major benefit. The primary portion of the facility is fixed structure and has the nature of public works. This kind of activity cannot be done "offshore". The jobs would be produced where the urban population exists.

The dual mode conceptualization was done several years ago. All of the necessary concepts are in the public domain, which is perhaps also the reason why venture capital is not available for this major development. Congressman Henry Reuss became quite interested and tried to interest the DOT in beginning to investigate the potential. At one crucial phase in the investigation the Transportation Systems Center of DOT was asked to investigate the energy requirements of dual mode and they did a study that compared individual dual mode vehicles to fully packed, (remember the 6 to 8 passenger load factor) city busses. Of course what they should have looked at was the average load of the bus which would have made the system just as energy efficient as the automobile, no more and no less, and would have shown dual mode to be better than the auto or the bus. DOT made a recommendation to the appropriations committee based on their wrong assumptions and of course, the result was obvious.

In the mean time what has happened abroad. The Japanese came to see our student built prototype and they have now built two test facilities for van sized, dual mode vehicles. The Germans in the form of VW and Mercedes also became interested and Mercedes has completed a dual mode prototype that demonstrates a dual mode bus on a busway. In the case of the Japanese the funds were from governmental sources, I am not aware of the sources of funds used in the German experiments.

I suggest that dual mode is another type of candidate for enhancement of the efforts of the private sector that is necessary because of the entrenchment and presently the financial chaos of the Automotive sector. What is needed may not be federal funds but rather better security of private investment of funds. If we accept the economist's argument that more personal savings are necessary in order to improve the economy via better capital formation, then the economy must be aided by any system that protects the rewards for risk. The stock market is not only responding to high interest rates, it is also showing a complete lack of faith in equity investments.

The new product most likely to create the most jobs for Americans and give the greatest boost to the American economy is not necessarily the product employing the highest degree of the latest technology. Instead, it is the product whose factors of production are available only or mainly in the U.S., and therefore is difficult or impossible to produce abroad, that will contribute the most to American economic well-being. A case in point is the American highway system.

4 Previous Response to Mandated Automotive Re-design

During a study I was involved with at M.I.T. on auto safety, I became involved in a series of debates with Ralph Nader on his favorite subject, also automobile safety. At that time I took the position that Nader's activities would decrease innovation in the automotive industry. Ralph

argued, of course cogently, that he was forcing the auto companies to be more innovative. Two years later, Ralph called me at home one night and said, "I'm over at Harvard Square and would like to invite you over for a cup of coffee." When I arrived he said, "Dwight you were right, now the government is installing all kinds of rules based on political incentives," (he was referring to a number of particularly gorey films that had made the evening news calling for the replacement of the gear shift handle--when in fact some people know that the push-button shift had been responsible for numerous accidents). Likewise, he added, "Industry is adding all the devices that they can set the price on, and there's no one to keep them both honest." We brainstormed into the night for a way to address this problem, and alas I went home sorry that I had been right.

Thus our society, in responding to the regulation of auto safety at the national level, had created a situation where the cost of making any changes, good or bad, became very high--this was the basis of my original arguments with Ralph. At the same time the process of law that assesses blame in civil liabilities has developed the concept, even over protest from the finest practitioners of the art of engineering and law, that change itself was tantamount to the admission that the previous embodiment was not safe. Gone is the prudent man concept of common law, and now we have the strict liability laws that also favor foreign corporations that can dilute their exposure with product sold in countries without the same requirements.

Once the public, the press, and the politicians developed the idea that they could effect the design of what is the largest basic, public interaction with technology and could actually make changes that would demonstrate its power over the evil forces of the industrial complex, we were well on the way to the present collapse of one of our largest domestic manufacturing industries. The subsequent activities, first with safety, then with pollution and finally with efficiency, developed an automotive supply system where it is impossible to separate out the causes and the effects or find out who to blame. The resulting designs and costs of these "Committees to the squared power" designs made it likely that the me-too designs of the second round or of any new entrant into the marketplace would have the financial advantage. In fact our society had developed a way of increasing the cost of doing business without allowing the investors to protect their investment.

The auto companies were of course not blameless in these interactions. Their cardinal sin was the fact that they had also become bureaucratic, and did not anticipate the technological changes in the marketplace as fast as did their foreign competitors. After all, the prediction of technological change is a technical skill. They were attempting to make these predictions with financial analysis. Even, or perhaps especially when the change is directed by Government there are technological limits and realities that might have been understood and anticipated by technologists and social and political scientists.

Along with "eating their seed corn" (The industrialists may argue, the government made us do it.), the auto industry had not been paying attention to the fact they were spending what should have been their reserves for depreciation on increased labor costs, and even paying dividends on stocks, (risk capital) that while intending to show reward for risk, was actually liquidation of plants and equipment.

In contrast, a friend of mine, Prof. Bella Gold of Case-Western University in Cleveland tells of a conversation he had with the president of a major Japanese steel company. Gold asked why the industrialist was modernizing and updating a steel mill only 8 years old (newer than any U.S. plant) to utilize the latest energy saving and labor saving technology. The industrialist answered, "We got the idea from your man Shakespeare--To be or not to be".

The Japanese automotive industrialists paid attention to technology, their own increasing labor costs, and our regulatory environment. Their technologists seemed to be better at guessing what would happen next than we were. Perhaps the American sin was the fact that technological forecasting has not been taught or perhaps not even been understood at our major business schools. The focus on the quarterly bottom line seems to exacerbate rather than aid this process.

In other instances of governmental intervention regarding direct technological change in transportation components, the results have been similarly disappointing. The activities of UMTA in attempting to orchestrate change in the mass transportation field have been largely unsuccessful. The attempts to produce a better city bus, people movers, taxi and paratransit vehicles, better rail-propulsions, suspension, traction, power pickup, and control systems--have shown little tangible results. With all this technology, Pittsburgh is still building a trolley system that will be much like the obsolete one it has been patching up for 90 years. Morgantown's people mover is not being replicated. The people movers at airports have borrowed as much technology from Disney World as they have from government sponsored R&D. The transbus is not being built and may have been responsible for some of American Motors financial troubles. The "new" subway cars have cracked frames and in general its hard to see much progress.

In retrospect the primary problem of the UMTA experience has been the method of procurement for so-called R&D. Several methods of procurement have been attempted, ranging from partially supported financial incentives to four different suppliers for the transit truck and propulsion units for Bart, to the panic letting of bids to an aerospace company to start building the Morgantown people mover in time for election, and the elaborate design and feasibility staging of the ill fated Transbus.

In fact the major lesson learned by industry from the UMTA experience, has been not to trust the government to follow through on procurements, even if industry does try to comply with

governments design and development initiatives. The history is so dismal that unless all of the funds to implement H.R. 5880 are appropriated, up front, I don't think any American firm will take time to even read it. Partial funding should not be attempted; staging of the program will not be believed.

The UMTA experience has been driven more by the fear of the charge of conflict of interest than by the possibilities of the commonality of interest. (The Japanese seem to take the same issues for which Americans look for and assume conflict unless proven otherwise, and they assume commonality.) Thus in the UMTA experience there have been no suppliers of technology, either in the form of R&D, design prototypes, for first run production, that have ever participated in a follow-on contract. That means there has been no learning curve at all. Even the Russians have realized the benefit of having Tupolov and his son become expert in designing airplanes. The conflict of interest mentality of our governments procurement policy, is itself an interesting phenomenon of post WWII government.

During the war and in part during the later major government works project called the "moon shot", there was a great deal of selection of the designers and the researchers. Does Congress not know that especially in the time of alleged urgency, the mechanisms of procurement focus, as they should, on the best potential supplier--not on the lowest arms-length bidder. At the same time as we seem possessed by the concerns over conflict and competitive bidding, we find that the major portion of federal procurements is by negotiated contract, with only a small percentage on competitive bid. It seems inappropriate to have that small percentage be concentrated in the areas that require the greatest creativity and thus the rarest talents, and the manufacturing that is well specified is given to pre-ordained "bidders". The procurement by formal Request for Proposal requires that the highest degree of innovative talent reside in the persons who prepare the request. If they create a document that cannot be responded to by several, better yet many bidders, they are not doing their jobs. Most innovations and all inventions come from one single source, usually after even a long-felt-need has created an atmosphere where many potential inventors and innovators could have known about the need, but did not, or could not come up with the solutions. The very definition of creativity implies that it is a very rare event, one not likely to respond to a federal RFP.

5 Probable Outcomes of Implementation of H.R. 5880

The questions of the probable results of the application of H.R. 5880 revolve around several factors. Assuming that the technological considerations are sound, given the modifications suggested in the previous section, the next most important consideration is the question of whether the competition would attract competent participants. Related to this question of competence, a loaded word which of course assumes resources adequate to complete the job, are the questions

of whether, given the successful production of the prototype vehicles and even the 10,000 production run, would the ten thousand and first vehicle be made in America?

The issue then becomes what would happen after the first stage. Although the proposed competition is limited to firms owned by U.S. citizens, there is no guaranteed that the U.S. firm would not be bought by a Japanese or German automaker rather than an American one. The subsidy for the short production is appropriate in order to make sure that the competition is successful in producing an automobile. On the other hand, the real prize is the access to the American market in a manner that provides a competitive advantage as compared to the competition.

Battelle Memorial Institute admits that Japan is probably further ahead in research and development of super-high mileage cars, and that West Germany's Volkswagen may be ready to market a car in the 72-90 miles per gallon range within the three-year time-frame of the H.B. 5880. This means that after the competition was all over, the economic warfare would be the same as before.

The primary purpose of H.R. 5880, as I understand it is to encourage the revitalization of the automotive industry in America. The secondary purpose: To reduce the energy requirements for automotive transportation, has several implications. One may assume that energy saving is itself an important goal--but if energy per unit distance of travel may not be the correct parameter. What if we find that increasing the energy efficiency simply leads back to increased use and thus the same or even more consumption. The point is that the conservation issue includes the entirety of the individual economic choices that include the tradeoff of what each individual may choose to do with his/her own personal wealth. From my studies of transportation, I believe that decreasing the fuel consumption for the private automobile would simply increase its use and that consumption of fuel would remain the same. Of course, this body representing our society's wishes and goals could conclude that more transportation for the same fuel consumption is good, and thus an important goal.

5.1 Analysis of Past Responses to Energy Problem

I should like to suggest, that the automotive fuel consumption, per se, is not the appropriate issue, but rather the question should be faced, "What strategy is more important for the long run when the liquid fuels are depleted and thus a scarce commodity with the resulting rapid increase in prices and the large impact that such an event would have?" Furthermore, we must address the question of the degree to which the solution to this long range problem creates more short range problems than it ameliorate. Need I suggest the possibility that Congressional activity in the form of "Safety Legislation" provided enough public satisfaction with the concept that the

Detroit engineers could be forced to do some things that they otherwise were disinclined to do. Congress, for the public, was saying that the auto industry's market surveys, their organizational and internal bureaucratic restrictions, and their capital formation constraints and limitations did not induce enough dynamic.

Since our society responds to success, with vigor, the Congress next felt it important to continue to demonstrate leadership by passing the Clean Air Act, followed by the spate of legislation dealing with some of the consequences of the Clean Air Act and to some considerable degree, the National Highway Safety Act,--The Energy Crisis.

There is more than a little evidence that the unplanned for and thus excessive energy consumption of the Clean Air Act, had a sufficient effect, on the order of 10 percent, on the energy consumption. Given that the transportation habits of our society are not changed suddenly, without travail, a crisis ensued. I understand the need to be responsible for correcting an effect that may have been caused by a collective misjudgement of oversimplification, by another overt act; but, the responsibility this time should be to treat the disease, not just the symptoms.

The approach of H.R. 5880 is of course different than either of the past experiences in trying to enhance change in automotive technology or in trying force new technology for urban mass transportation by so called, "defense and aerospace" procurement policies. The concept of a prize, or reward In contrast to the previous procurement considerations has many differences.

6 Alternative Congressional Actions and Historical Precedents

The strategy indicated from the previous analysis thus agrees in principle with the development of Automotive Research Competition Act, and agrees with the statement of the technical goals with slight modification. However, the reward structure is neither adequate to obtain the long term goals of the act, nor is it the least cost to the government or most strategic method of obtaining the desired long term economic goals.

As has been stated before the real prize is access to the American market in a manner that provides a competitive advantage as compared to the competition. The financial bonus described in H.R. 5880 would provide some incentive to a certain kind of financiers; however as has been pointed out, even if successful, the next automobiles would still be built where the labor costs are lower. Furthermore the ownership of the firm is not really as important as the location of the firm. We are now in world economic situation that has very fluid capital. I don't believe we should be directly subsidizing industry to do exactly what we are at the same time blaming the Japanese for doing. That game, or the international game of protective tariffs is easily countered and the escalation of such a path of direct subsidy has no logical end point--except to increase the amounts.



What is desired is a policy that is specifically designed to be temporary and is in line with other, well understood concepts. Thus the solution would not be as prone to upsetting massive, international trade patterns and it would be possible to explain the process in terms that the citizens understand. The presence of the President of the Battelle Institute in these hearings and the interest his organization has had in innovation is but an instance of a concept that is well understood. The Xerox patents were understood to be the reward for the inventor, yes. However, they were also the reward for those who helped the inventor, when no one else would, and they rewarded the investors and other stakeholders such as the employees as well. Except for a few other corporations, who appeared to be concerned during the latter, the most successful periods of the Xerox patent life, most Americans were appreciative of the contributions to society that had been rewarded by the limited monopoly that society, in turn, granted to Chester A. Carlson and his supporters.

My proposal thus is: That the Concept of the Letters Patent be re-enlarged to include the successful developers of systems that accrued to the public good.

In our post industrial age the primary shortfall as regards industrial innovation is not the lack of technology, it is the lack of technologists and financiers who will take risks in America. The rewards for risk in the manufacture of products that are mass producible, is the fact that a second source of supply, somewhere else in the World can be developed rapidly. There is no longer a potential for a even a limited monopoly on the basis of available capital because capital now moves from country to country on the basis of reward for risk. And I believe it should be allowed to do so for many other reasons.

The primary advantage of America has not been its price efficiency of labor, for some time now. The primary advantage is not the rapid access to capital, although that is still relatively strong. The primary advantage is simply the ratio of technologists per capita. This has allowed the country to be a leader in new technology, even though it can no longer continue to produce items that are mass producible. The development of the "robot" has been cited as a panacea, it is not. It is simply a requirement of competition with other nations who use robots. The use of programmable robots will reduce the competitive technological advantage of the U.S. because smaller production runs can be made with less technologist involvement, and these will likely be used where the cost of labor to watch the robot is less. The robots themselves will be manufactured automatically, and there is no indication that it will be done here.

The problem of keeping the means of production within the family or the nation are not new. King Ahab, king of Samaria was denied the purchase of Naboth the Jezreelite's vineyard in Jezreel (IKings 21,1:5) because of the disalienation laws described in Leviticus 25. Remember also that even when Ahab's wife Jezebel caused the owner of the land to be killed, Elijah meted out the punishment.

The State Constitution of my home state North Dakota does not allow land, their means of production to be owned by foreign corporations, to this day for the same reasons. The concept of disalienation protection has emerged throughout the years in various other forms. The means of production associated with manufacture resulted in the concept of the Crown of England giving "Letters Patents", letters to the public that stated the terms of a granting of a specific right for a specific purpose. At various time the policies in England encouraged, and sometimes discouraged foreign ownership of these rights, depending on the need for foreign technology or the need for industry or jobs. As a mater of fact, the concept of succession to these rights became the mechanism for the development of the corporation.

The disalienation concepts traveled to America in several fashions. Alexander Hamilton believed in the giving of bounties and setting tariffs to develop the national economy, even in the face of Adam Smith's admonition against doing so. As the patent law developed, it eventually became restricted to the granting of a patent as the reward for invention only, but in the stages of development had several important phases. The Act of 1793 broke the tradition of British law by excluding aliens from the right to hold a patent. This total exclusion of foreigners from patent rights was changed when the Act of 1800 was passed. It contained a provision that extended the rights of patent privileges to aliens who had lived in the U.S. two years prior to the time of their petition. Shortly before the passage of the Statute of 1836 the provision requiring two years of residence for foreigners was eliminated. This was done to accomodate an American manufacturer who wished to use a new process of rope manufacturing that had been developed in Europe. Congress waived the residency requirement because it felt that the European process would be beneficial in the United States navy yards.

The early Congress spent much time debating issues such as whether the patent rights for a foreigner to refine sugar in Philadelphia was in the best interest when it was a substitution for buying sugar that was refined elsewhere. Soon it was decided that the appropriate condition was that the production means were domestic even if the ownership was not.

In our present situation is is not apparent that the need exists to protect the flow of capital from country because the value of the capital rent does not seem as important as the provision of basic employment. Furthermore the provision of employment is the basic mechanism of providing a potential for increasing the savings of the necessary middle class. Thus the savings can provide the means for investment.

The concept of granting a patent right for the development of a transportation system had animportant precedent when James Rumsey was granted specific rights the the Congress on May

1785 to:²

. . . that 30,000 A. of land in the new Purchase to the West of the Ohio be given to James Rumsey provided he shall before the first day of May next produce good and sufficient Evidence that by means of certain Mechanism of his Invention Wrought or aided by three men only, a Boat carrying ten tons has been moved for six days in succession against the stream of the R. Ohio at the rate of 50 miles pr.da. Which Land he shall receive by a draught to be made out of the first surveys that shall be transmitted to the Treasury after the necessary Proof shall have been made.

I thus propose that the reward for performance of the task called for in H.B. 5880 be rewarded by the granting of a letters patent of a specific type:

I suggest that the concept be developed and called a "Systems Patent" to include the first reduction to practice in a form appropriate for mass production of a system to be specified by the Congress from time to time, that was deemed to be in the public interest. These Systems Patents would terminate after 5 years starting with the first date of production. The grant would terminate before that time if it was superseded by new technology that exceeded the original specifications by significant amounts. In the case of a succession, the original rights may include a royalty arrangement for any of the subsystem components developed by the first producer that are still maintained in the succeeding production.

The rights to a systems patents could be assigned only for the manufacture and production of the entire needs of the U.S. market, with 75% of the components manufactured within the U.S.

²*Journals of the Continental Congress, XXVIII, 349*

Mr. SHAMANSKY [acting chairman]. Thank you very much, Dr. Baumann.

I would just like to comment before we leave that some of what we do here is actually done with what we call the political realities in mind. It comes as a surprise to you, I am sure, but I think that is true.

Regretfully, I was out of the hearing room at the time you began. Are you saying it has been your experience that it is difficult to have innovations adopted by the—

Dr. BAUMANN. The auto industry? Any industry that is so large that making a mistake is verboten—

Mr. SHAMANSKY. It is sort of systemic.

Dr. BAUMANN. We have had our Edsels, and you do not make very many of those.

Mr. SHAMANSKY. I see. So, you learn to be very cautious in the business; is that right?

Dr. BAUMANN. General Motors invested \$5 billion last year in development and plant and tools, so the concept of \$100 million is small in comparison.

The Japanese have a different mechanism, because first of all they are new; second, they have seven or eight companies competing toe to toe in their own country for their own domestic market, and only the most successful are allowed export rights. So, they have a method of honing these vehicles into good shape.

We have lost that because of our installed plant, because of a lot of bureaucracy.

Mr. SHAMANSKY. Do you believe that other centers of engineering and manufacturing exist in this country who have the capability of putting together an automobile?

Dr. BAUMANN. If you give any industrialist I know a 5-year patent—

Mr. SHAMANSKY. Excuse me. Holding that aside, because that is another whole issue, I think you appreciate—that subject aside—do you believe that the expertise exists in this country?

Dr. BAUMANN. To build a 100-miles-per-gallon car? Yes.

Mr. SHAMANSKY. Build it and produce it? I do not mean just prototypes.

Dr. BAUMANN. So far as we know, it does not violate any laws of physics that are terribly serious.

Mr. SHAMANSKY. OK. In other words, it is doable?

Dr. BAUMANN. Yes.

Mr. SHAMANSKY. In purely practical terms, it is a doable project?

Dr. BAUMANN. Right. Now, it is not necessarily cost effective. I think Maxine Savitz's letter to Senator Stevens is relevant. In other words, it is not really a matter of being cost effective; it has to have a goal sort of greater than the cost. And the energy goal might be such, but I am suggesting that there are other goals that are greater and that could be established by a rulemaking procedure which says, "Look, fellas, anybody who gets here firstest, we will help you."

Mr. SHAMANSKY. Without in any way challenging your assessment of the advantage of a patent, the kind of innovation you are talking about for a legislator like me who is also a lawyer—that is so innovative that I would have to think about it. But I just wanted

to concentrate and take advantage of your experience with respect to the engineering and manufacturing challenges presented by these criteria.

Dr. BAUMANN. Sir, we have some rules of thumb in engineering that we do not make breakthroughs or order of magnitude changes without a new invention, but anything that is a change of 20 percent, 50 percent, or maybe even double can usually be approached by a lot of hard work incrementally.

The question of the increments is the real issue in the automotive industry, sir, because if one built a car that met the 100-miles-per-hour spec and it was not based on somebody like Volkswagen or Chrysler's chassis, the first time it broke down we could not get a wheel for it. We are so dependent on the whole aftermarket, the whole infrastructure of the automobile.

Mr. SHAMANSKY. And that would tend to put a premium of just making increments of 2 percent as opposed to anything beyond 2 percent.

Dr. BAUMANN. That is correct.

Mr. SHAMANSKY. And it would take 25 years to make a 50 percent improvement; is that correct?

Dr. BAUMANN. That is correct.

Now, the increments of greater extent I say require a more significant reward. The reward of money to most entrepreneurs is not adequate, because they will just spend it, and it will be all gone. The reward they want is to have a challenge that nobody else can meet and that they feel they have met.

Mr. SHAMANSKY. OK. Dr. Baumann, I want to thank you very much for joining us here today. We will call the hearing to a close. Thank you very much.

[Whereupon, at 11:57 a.m., the hearing was recessed, subject to the call of the Chair.]

